OCTOBER 1961

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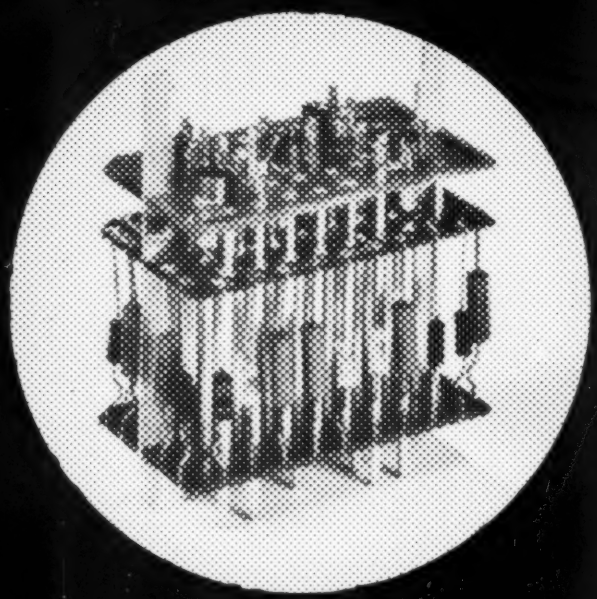
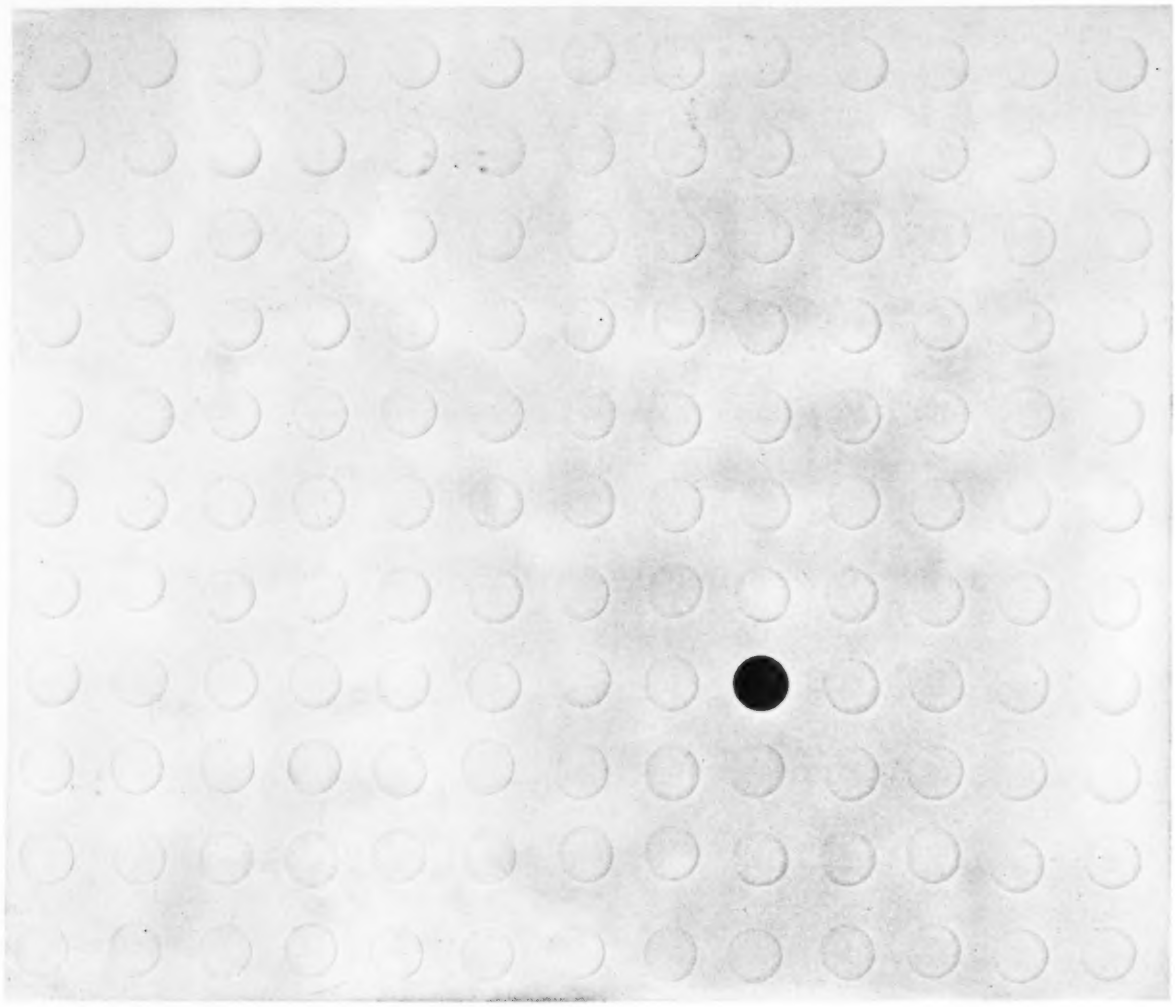
THE MAGAZINE OF AUTOMATIC OFFICE METHODS AND MANAGEMENT





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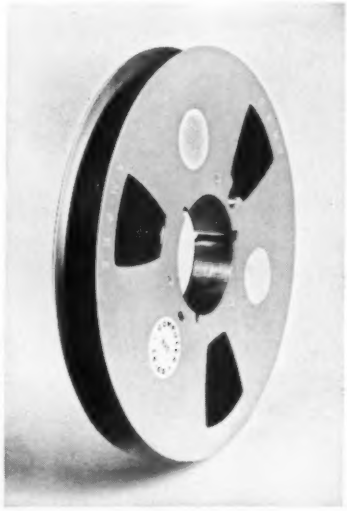

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Volume Three • Number Ten

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OBSERVATIONS . . .

DP OPPORTUNITIES

MOST GROWTH PROJECTIONS that we have seen for data processing have been related to equipment. We recently finished reviewing a report on projected needs for data processing personnel. This report was prepared by management consultant, Calvin J. Goodman, for the Los Angeles school system.

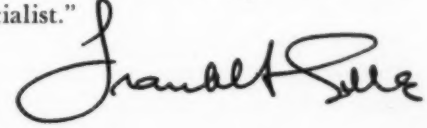
The most dramatic prediction in this report was that by 1966 there would be 170,000 data processing specialists and by 1970, 500,000. Data processing specialists were defined as persons above the machine operating level, including department managers, programmers and systems analysts. Equipment to include both punched card and computer systems.

After first reading these figures we contacted Mr. Goodman to verify the methods employed in his projections. We are satisfied that the sources used are probably the most reliable that are readily available.

Regardless of the complete accuracy of the figures themselves, they certainly suggest a growth that is perhaps unprecedented in the annals of business history. However, these specialists will not be created by the mere suggestion of their need. Important steps must be taken to assure that they will be available in sufficient numbers and properly trained.

Even more significant than the figures in Mr. Goodman's report is the following: "The need is for educated specialists who can grapple with complex business problems — not for narrowly trained technicians who cannot adapt themselves to ever changing circumstances. [Managers] concentrate too much on machine skill training — rather than on sound theory and practical applications of data processing to business problems."

Hurrah! for Mr. Goodman and his Los Angeles survey. Another hurrah for the three recommendations contained in the report to attack the educational problems present and future: "1) Upgrade or broaden the courses for workers now employed in data processing. 2) Develop new courses for future specialists who will need to know more than the technical characteristics of a computer system. 3) Provide orientation courses for the non-specialists who will work with the specialist."



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AUTHORS

JAMES A. JOYCE *(Simulating Hardware)* is a First Lieutenant in the U. S. Army. He graduated with a bachelor of arts degree in journalism from the University of Nevada in 1959, and did five years of newspaper and wire service writing before, during, and after college. He entered service on a two year tour of active duty in February, 1960, and is assigned to the data processing department of the Adjutant General's School, Fort Benjamin Harrison, Indiana, where he instructs Army and government personnel in programming, equipment features and systems analysis.

PAUL KING *(A Total System Concept)*, co-designer of the B5000 Information Processing System, is manager of Burroughs Corporation's Systems Evaluation Department, Product Planning, at Pasadena, California. A mathematician by profession, he was graduated from the California State Polytechnic College and served as a computer programmer for Lockheed Corporation for two years before joining Burroughs in 1954. Mr. King was responsible for developing design concepts of the B5000 and subsequently was a key figure in fitting the new approach to hardware.

ROBERT V. LEWIS *(Top Management Participation)* attended City College of New York where he majored in mathematics.

He joined Grace Line Inc. in 1954, where he originated the first electronic steamship billing system, using an IBM 607 electronic calculator. He installed a 650 tape system in 1957. He was transferred to W. R. Grace & Co. in 1959 to become manager of electronic systems research, responsible for the application of advanced electronic data processing systems to the entire W. R. Grace Corporation. Mr. Lewis is also an instructor in the Management Institute, New York University, teaching electronic and tape processing systems and office automation.

(continued on page 54)

NEWS SUMMARY

GENERAL

Information processing information will be exchanged among the information technologists of all countries at the IFIP Congress to be held in August, 1962. Sponsored by the International Federation of Information Processing Societies, the U. S. member will be AFIPS (former Joint Computer Committee).

IEC Technical Committee 53, in charge of standards work relating to graphical symbols, input-output media involving magnetic tape and the levels of current, voltage and impedance for data transmission, will meet in London in November, 1961, for its first organizational session. This committee evolved from the June meeting of the International Electrotechnical Commission in Switzerland.

"The Supply Manager's Dilemma," an animated color film by Planning Research Corporation on scientific inventory management, received the 1961 Blue Ribbon Award by the Educational Film Library Association.

FINANCIAL

IBM for the six months ending June 30, had net earnings of $100,859,439; up roughly $24 million, $3.67 a share.

National Cash Register for the six months increased sales 16% over 1960 period; net income $8,135,853 (up 7%), earnings $1.02 a share.

Electronics Associates, Inc. dropped to $404,000 net income on an increase in total sales over previous year with a drop to 48 cents a share from 52 cents in 1960.

Dictaphone Corporation shows gain in sales and profit for first half; net profits were $748,000 or $1.23 a share.

Standard Register Company continued higher volume and profits for first half; earnings jumped by 15.5%, with net income at $1,527,640, equivalent to $1.44 a share.

C-E-I-R, Inc. has sold to Investors Variable Payment Fund, Inc., $3,044,000 worth of securities, the money to be used for expansion.

BANKING

NABAC (Association for Bank Audit, Control and Operation) is beginning a program of helping all banks in the country install sounder internal audit control programs to counteract the wave of frauds and embezzlements of the past year. The program will be carried into all 50 states and Puerto Rico.

The Bank for Savings, New York state's oldest savings institution, has ordered two NCR 315 computers for savings deposit accounting.

The Federal Reserve Bank of Philadelphia has ordered a second 1401/1412 system.

The Citizens and Southern National Bank of South Carolina demonstrated its 1401/1412 data processing system in July.

NEW USES AND USERS

The Dayton Power and Light Company is establishing a data processing center, the first in the utilities field to use magnetic imprinting on customer bills. The center will be built around two NCR 315 computers and will use CRAM (Card Random Access Memory) files.

Guarantee Reserve Life Insurance of Hammond has installed an IBM 7070/1401 system.

MORE USES AND USERS

The Houston, Texas, C-E-I-R service center has installed an IBM 7090.

The Sessions Company, management consultants, has ordered a GE 225 computer system.

J. C. Penney introduced an IBM 1401 system into its Pittsburgh regional credit office to handle accounts receivable -- claimed as a first for the retailing industry.

Grumman Aircraft Engineering Corp., of Long Island, received its second IBM 1401, which was also the 500th 1401 that IBM has delivered.

The New York Telephone Company ordered 17 Farrington optical scanners, the biggest single order to date for the scanners.

Wyandotte Chemicals Corporation has an IBM 1401.

Duke University became the fourth university in the U. S. to acquire an IBM 7070 computer; it will be used in the school's digital computer research program.

Eastern Air Lines will have a new electronic reservation system by the end of this year at Charlotte, N. C.; they will use a Univac 490 Real Time Air Lines Reservation system.

Fuller Company, Catasauqua, Pa., has installed an IBM 1620 data processing system.

Gulf Oil Corporation has ordered a multi-million Addressograph-Multigraph credit card system.

Minute Maid Company, Orlando, Fla., a division of Coca-Cola, will use an NCR 304 system for its new Management Information Services department, and will offer service bureau facilities to outside firms.

Monsanto Chemical Company purchased four Honeywell 290 digital computers for on-line process control computation for its upcoming Chocolate Bayou, Texas, hydrocarbon plant.

Neisner Brothers, Inc. have a Univac SS90, the first electronic computer to be used anywhere in variety chain operations.

The Public Service Electric and Gas Company, Newark, N. J., will lease one RCA 601 and five RCA 301 computer systems.

Spiegel, Inc. leased two Dashew Databossers for creating embossed address plates as part of its integrated data processing program.

Denver & Rio Grande Western Railroad put their elaborate communications and information processing system into operation; this consists of an A. B. Dick Videograph (facsimile transmission and reproduction), Burroughs 220 computer, Motorola Communication's microwave, and Western Union leased lines.

EXPANSION

Columbia Ribbon & Carbon Manufacturing Company has completed a new research facility at Glen Cove, N. Y.

Scientific Development Corporation opened offices in Watertown, Mass. to handle scientific educational devices.

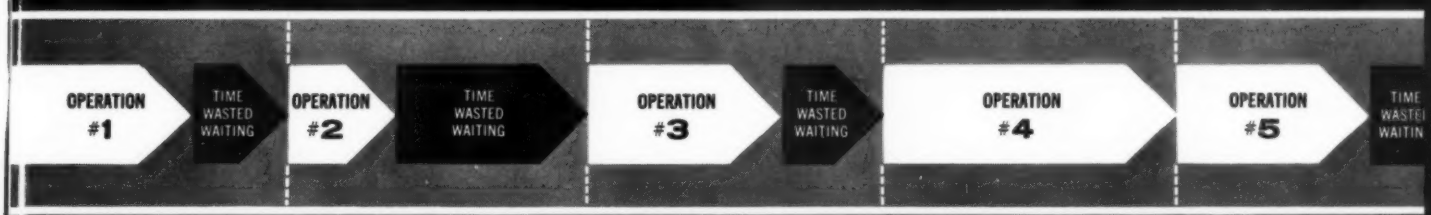
U. S. Engineering Company, subsidiary of Litton Industries, added space for engineering facilities, research, storage and offices.

Westrex Recording Equipment division of Litton Systems moved to larger quarters in Beverly Hills.

Univac created an Industrial Component Sales Department to market components, assemblies or parts for its data processing equipment.

Your Computer is Wasting Time and Money!

[unless it's asynchronous]



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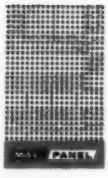

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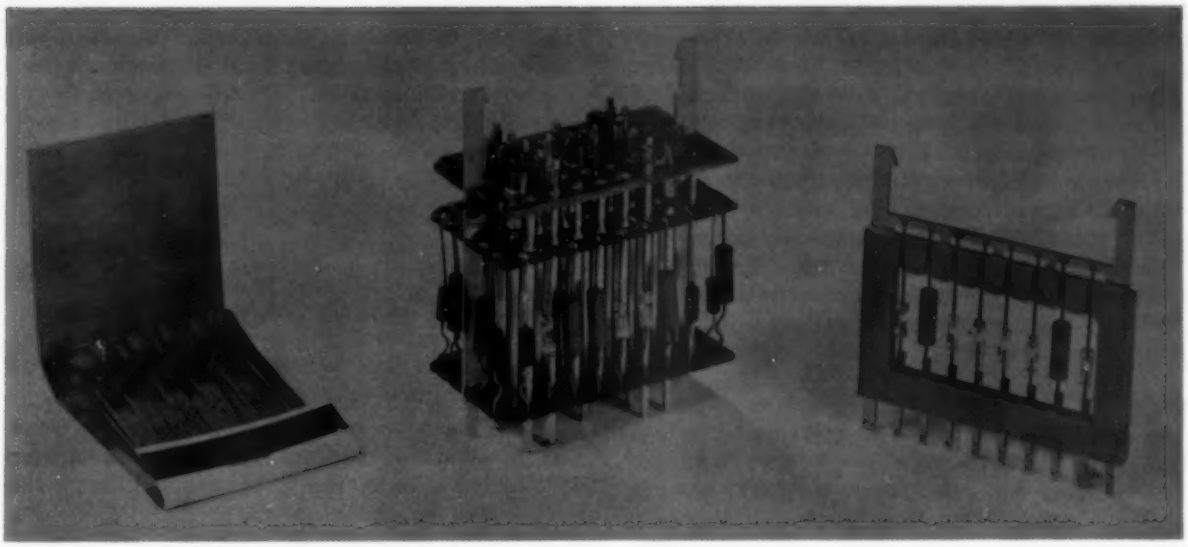


Tiny transistorized packages, shown here in relation to an ordinary matchbook, are the standard plug-in units in the new B5000 system. Use of these standardized solid state "stick" (right) and "parallel plate" packages reduces spares needed on site by 60 percent. High packing density and ease of component replacement are other significant advantages of the standard packages.

The Burroughs B5000

A Total System Concept

Conceived to overcome problems created by older computers

By Paul D. King

THE ELECTRONIC DIGITAL COMPUTER is just 15 years old. The history of its applicational evolution is well known — first scientific problems, then business data processing, and, more recently, the controlling of processes and even biological simulation. The history of its engineering or design evolution is also well known. The first systems were designed to solve scientific problems by arithmetic processes. Since then, little change has been made in the basic organization of systems. The improvements have been largely restricted to the use of newer, faster and more reliable electronic components. This type of evolution led finally to several "super-large" and "super-fast" systems which, it is believed, will be the last of their breed.

Although digital computers have become widely used, powerful, problem-solving tools, they have also tended to create some new problems. Because they are instructed in esoteric machine languages, they are not widely used by technical people directly. Instead, an entirely new field of problem-to-machine-translation, called programming, has of necessity come into existence. Good program-

mers, who are relatively scarce, are often the major factor in the success or failure of a computer application. Because of the large investment in an operating program and the difficulty of changing an old machine language program (the fellow who wrote, debugged and understands it is probably no longer around), management is often prevented from making changes it would like to make. Because systems have become so large and complex, it has become quite difficult to schedule and operate them effectively and efficiently. These are typical problems computers have generated for their users.

Software

In an attempt to make computers easier to use, automatic programming systems have been developed. They are sometimes referred to as the "software" of a computing system. Included in automatic programming systems are such things as compilers and operating systems.

A compiler is a program which allows the computer to translate a problem statement from one language to another — from a language which is easy for the human programmer to understand to the language the machine understands. With compilers, it is no longer necessary for the programmer to translate the problem into machine language; he states the problem in an easy-to-use language designed for the particular class of problem. Among the many languages in use are two noteworthy examples, COBOL (*C*ommon *B*usiness *O*riented *L*anguage) for commercial problems and ALGOL (*Algo*rithmic *L*anguage) for scientific problems.

An operating system is a program designed to relieve the operator of many routine tasks. Some of the tasks relegated to an operating system are the loading of programs from a library of programs, creating an operating log for accounting purposes, and the analysis and correction of errors. Further, an operating system monitors the operator to verify that the correct magnetic tapes and card files are loaded. The operation of a computer under control of an operating system ensures smoother flow of work through the system, greatly reduced chance of operator error and accurate recording of system usage.

The Burroughs B5000 Information Processing System is the first computer which was consciously designed from the start as a *total* system. Instead of considering the computer just as a problem-solving tool, great attention was given to how the tool is used and the environment in which it is used. Conventionally, a "hardware" system was designed first, and then an automatic programming system was developed to fit the hardware. In the case of the B5000, both "hardware" and "software" were designed *concurrently*. The two fundamental objectives of this approach were the reduction of problem "through-put" time and the facilitation of "changes" both in programs and system components.

Objectives

As a prelude to the design of the B5000, the following aspects of the total computer utilization problem were identified and considered:

- The need to be able to express problems in machine-independent source languages (that is, not related to any particular computer) which are close to the natural language of the problem and easy to learn and use.
- The need for improved compilers which could automatically produce highly efficient machine language code from programs written in the source languages.
- The need for compilers which could produce machine language code at such a high rate of speed that it would be practical to maintain programs in their source language and to always "compile and go."
- The need for practical program "debugging" in the source, not machine, languages.
- The need to reduce lost system time during problem set-up and load operations.
- The need to improve the efficiency of the total system operation.
- The need to permit easy changing and upgrading of programs.
- The need to permit changes in system configuration, such as the addition or deletion of memory or tape transports, *without the necessity for reprogramming.*

With these objectives in mind, it was apparent that a new approach to the design of a computing system was required. Two basic assumptions were made: first, that higher level programming languages, such as ALGOL and COBOL, should be used to the virtual exclusion of machine language programming; and second, that the system should largely control its own operation. Both assumptions, if zealously adhered to throughout the design phase, would result in some profound changes in the organization of the system. The first assumption demanded that the system be designed to meet the requirements of automatic rather than machine language programmers. The second demanded that the system be designed for self-control through a comprehensive operating system rather than for operator control by means of switches and buttons.

Polish notation

Many of the newer compilers have utilized a parenthesis-free notation called "Polish Notation."

The writers of these compilers turned to this language because it is particularly well suited to their needs and because it is free of ambiguity. The B5000 operates directly on compiler-produced "Polish strings." "Pushdown stacks" are incorporated in the hardware to greatly enhance the use of the Polish notation. These stacks also eliminate the necessity of assigning temporary storage locations. Other powerful features, such as the following, have been provided to make it possible for writers of the B5000 programming system to achieve their objectives:

- Programs are not only independent of their location in memory but also may be located any place in memory without modification.
- Programs are independent of the location of the data.
- Contextual addressing is used to reduce redundancy and hence achieve maximum efficiency in the use of core memory.
- Subroutines can be "nested" infinitely deep and used recursively. The "return" procedure is built into the hardware.
- Generalized indexing is provided rather than any specific number of index registers.
- A full complement of logical, relational and control operators are provided to enable efficient translation of higher level languages.
- A single representation is used internally for fixed and floating point numbers which permits their intermixed use without concern.

Self operational

Many of the better computer installations have developed their own standard operating procedures to increase efficiency and to maximize system productivity. As is perhaps obvious, one natural way to do this is to utilize the computer as much as possible to schedule and run itself. Many such "operating system" programs have been written, but too few of them have been notably successful. One of the major reasons for this is that conventional systems have been designed for operator control rather than self control.

As has already been pointed out, the B5000 was designed from the start to be operated by a comprehensive operating system called the Master Control Program. Most of the normal system conditions which arise as an application is being run, and which ordinarily halt a system or require operator intervention, merely cause an automatic program "interrupt" in the B5000 system. Many of the abnormal system conditions, such as parity check failures, are handled in the same way. By appropriate testing of a special interrupt register, the B5000 can determine exactly what condition has arisen and can initiate whatever action is required.

If action on the part of the operator is required, an instructional message will be printed out and the system will proceed with other work until the operator has complied with the instructions. Provisions have also been made in the system to permit it to determine for itself exactly what its own system configuration is at any time. One magnetic drum is a necessary part of each system. This is required to store all but the most actively used portion of the master control program and the compilers.

In keeping with its radically new and improved internal organization, the system also has a new macro organization. The programming system easily handles changes in system configuration; therefore, they are facilitated in the hardware. The system achieves its unique physical and operational modularity through the use of electronic switches which function logically like telephone crossbar switches. The general organization of the system, as well as the maximum system, is depicted in Figure 1 *(see page 56)*.

System Components

Processors — A B5000 system includes either one or two independent processors. Processors perform all computation and control the entire system. Operations are performed on either fixed-word length binary information or variable field-length alphanumeric information. Programs consist of

mathematical problem:

d=a(b+c)

ALGOL statement:

D := A x (B+C);

data processing problem:

FICA DEDUCTION = FICA RATE (GROSS PAY+RAISE)

COBOL statement:

COMPUTE FICA-DED EQUALS FICA-RATE
TIMES (GROSS-PAY PLUS RAISE)

Simple examples of the two universal automatic computer programming languages, ALGOL (Algorithmic Language) and COBOL (Common Business Oriented Language), show how closely they resemble their pure derivatives, algebra and English. Both ALGOL and COBOL will be standard on the B5000 system.

strings of 12-bit operators or operand addresses, packed four per word and executed sequentially. The operators or operand addresses are executed according to the rules of Polish notation. The clock rate of a processor is one-megacycle and the execution time of the basic add operation is three microseconds.

Memory modules — A system may have from one to eight independent memory modules, each module containing 4,096 words of magnetic core memory. A word consists of 48 bits plus a parity bit or eight alphanumeric characters plus parity. Memory cycle time is six microseconds and read-access time is three microseconds. Access to memory for input, output or processing is made through the memory exchange. The memory exchange allows several units to access simultaneously different memory modules and resolves conflicts when more than one unit attempts to access a single memory module.

Input-output channels — From one to four input-output channels may be incorporated. A channel controls the information flow between any input-output device and any memory module. When an input-output operation is initiated, the first available input-output channel is automatically selected and used. As many simultaneous operations can be performed as there are input-output channels in the system. The addition of input-output channels to a system allows a greater degree of simultaneity in input-output. This would result in a faster running system with no changes in the programs. The input-output channels connect to the peripheral devices through the input-output exchange and connect to the memory modules, as required, through the memory exchange.

Magnetic tape unit — Up to 16 magnetic tape units may be connected to a system. Tapes are read and written at a speed of 120 inches per second with densities of 555.5 or 200 characters per inch, yielding transfer rates of 66,600 or 24,000 alphanumeric characters per second. Rewind speed is 340 inches per second. The tape format is compatible with that of the IBM 729-II and 729-IV magnetic tape units. Reading can be performed in either a forward or backward direction. Write operations are automatically checked by means of a dual-gap read-write head.

Card equipment — A system may incorporate one or two card readers and a card punch. Two models of card readers are available, one operating at 800 cards per minute and the other at 200 cards per minute. Both model readers use photoelectric reading of the cards. The card punch operates at 100 cards per minute.

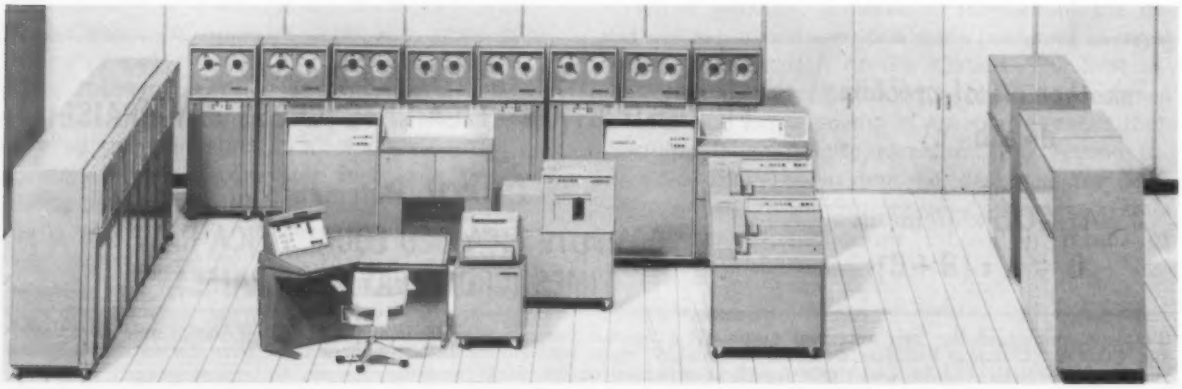
Line printer — The line printer operates at a speed of 650 lines per minute. There are 120 print positions per line and the character set consists of 63 characters plus a blank. Spacing is ten characters per inch horizontally and either six or eight lines per inch vertically. Vertical paper control is provided by a 12 channel paper tape loop. A B5000 system may incorporate two line printers.

Magnetic storage drum — Each system includes one storage drum; an additional drum may be added. The capacity of each drum is 32,768 words. Information is transferred to and from a storage drum at a rate of 123,000 characters per second. Manual switches are provided to lockout writing on sections of a drum. A portion of the first drum is used for storage of the master control program, compilers and various utility routines. The lockout switches prevent inadvertent destruction of these programs.

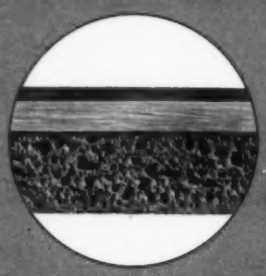
Message printer and keyboard—A message printer and keyboard are provided with every system. These units provide communication between the system and the operator. The message printer operates at a rate of ten characters per second. The keyboard provides full alphanumeric input of operator messages.

Provision is made in the system for the inclusion of a Tally plotter 201. This unit plots

(continued on page 56)



I'm standing on *Air*



WALK ON AIR! In the magnified cross-section you can see millions of tiny air bubbles in sponge rubber base. Base is permanently bonded to rubber tile.

RESILIENCE . . . . In the perfect degree for comfort but firm for proper support.

FIND OUT ABOUT the ultimate in resilient floor comfort. Write today for information with prices and full color sheet.

It's true! Provide your employees with Tab Foot Comfort Mats and Runners, and they actually stand and walk on air!

Glossy rubber tile is bonded to rubber cushion with millions of tiny built-in bubbles.

Runners are soft and quiet—noise is hushed because every footstep is cushioned.

Tab Mats increase efficiency. Typical installation shows girl working at Tab reference file. Everywhere that people stand to work, Tab foot comfort mats pay big dividends in morale, energy and productivity.

Circle no. 6 on reader service card.

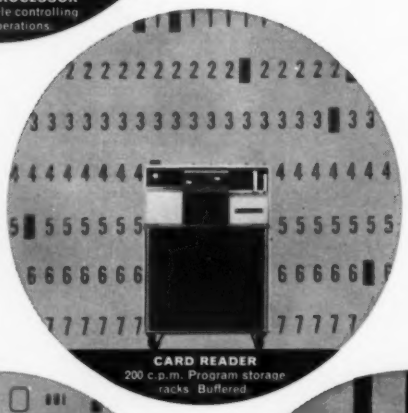
TAB
PRODUCTS CO.

995 Market Street, San Francisco 3, California

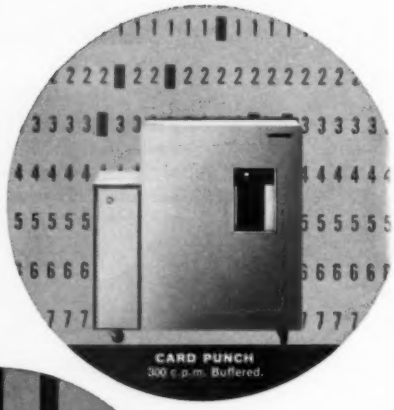
ANNOUNCING THE NEW BURROUGHS B 200

CENTRAL PROCESSOR
Computes while controlling system operations.

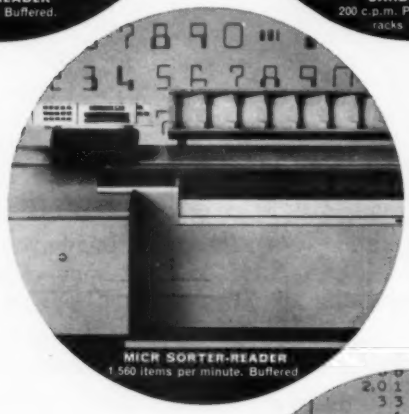
CARD READER
800 c.p.m. Buffered.



CARD READER
200 c.p.m. Program storage racks. Buffered.



CARD PUNCH
300 c.p.m. Buffered.



MICR SORTER-READER
1,560 items per minute. Buffered.

LEDGER PROCESSOR
Processes, prints on unitized magnetic records. Buffered.

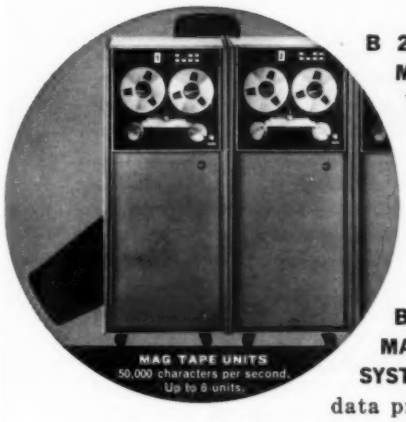
TAPE LISTERS
6 or 12 tapes. Buffered.

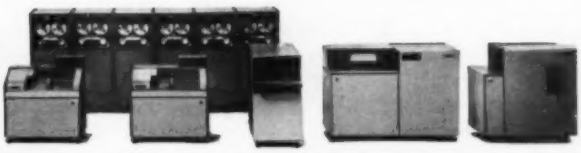
LINE PRINTER
700 l.p.m. Buffered.

SERIES OF ELECTRONIC DATA PROCESSING SYSTEMS

Custom-tailor a system for your specific needs with these new components

Whatever your input or output media, we can blueprint a B 200 Electronic Computer System precisely for your needs with these new off-the-shelf components. You'll have a system that will give you a significant increase in productivity. A system that's fully buffered. A system that reduces programming time and expense to a minimum. See how flexibly and efficiently these versatile components work together in the four representative B 200 configurations pictured here:





B 280 PUNCHED CARD MAGNETIC TAPE SYSTEM: It provides maximum flexibility in on-line and off-line equipment utilization. It can function also as a natural satellite to large-scale computers. Provides complete character sets for Algol and Cobol. And it performs card-to-tape, tape-to-card and tape-to-printer operations simultaneously—at rated speeds of input-output devices.

B 270 PUNCHED CARD MAGNETIC TAPE MICR SYSTEM: A general purpose data processing system for financial institutions, it simplifies applications such as demand deposit accounting, mortgage loan and installment loan. Offers cost-saving proof and transit operations, including preparation of cash letters. Utilizes magnetic tape units, card reader, punch, line printer, tape listers and sorter/reader.

B 260 PUNCHED CARD SYSTEM: It combines collation, computation, summarization and hard-copy preparation all in one run. Completely buffered for maximum throughput. Highly automatic operation and scheduling.

B 250 PUNCHED CARD AND LEDGER RECORD SYSTEM: It is unique in handling financial and commercial applications where unit ledger records are desired. Processes directly from input to output ledger. Offers the advantages of line printer, ledger processor, tape lister, MICR sorter/reader and card punching and reading.

For the configurations described above there is a powerful library of programs. Among them: A report generator which accepts mag tape or punched card input and produces object programs for immediate or subsequent use. A sort generator which accepts variable length records and from four to six tape units. An assembly program. And a full complement of utility routines. • Which system for you? A Burroughs Systems Counselor will be able to answer that to your complete satisfaction. Burroughs Corporation, Detroit 32, Michigan.

Burroughs—TM

Burroughs Corporation

Circle no. 7 on reader service card.

Marien on FORMS —A Monthly Feature

RAY MARIEN

Sizzle-to-Fizzle

IT WAS ROBERT BURNS who wrote that "the best laid plans of mice and men *gang aft* agley." Old Bobby had good reason to write such lines as a few of his "plans" backfired and he wound up on the *inside* looking *out* through one of those little barred windows. Such an unfortunate result doesn't happen to systems men, of course. When some of their projects "fizzle," (after taking off from the pad so beautifully) they just retreat in bewilderment and wonder uneasily if they'll get a second chance!

Many a sound systems plan has indeed worked out wonderfully for a time. Then, sometimes very suddenly, and at other times virtually overnight, it collapses. Why? That is what management needs to know. Why the *failure* after such a successful start? Obviously it represents a *costly* loss to the company; they had men and money invested in it. American private enterprise cannot resort to Iron Curtain subterfuge. The latter report *only* their *successes*. We report our *failures* as well. So we look around for the *fault*, the *weakness* in the system. And — nine times out of ten — we find that the fault lies *not* with the system, but with the *men* running it.

Sometimes, it's the originator of the system himself who runs out of gas. His *sizzle* turns to *fizzle*. Sometimes — but not often! Usually, he has enough sustained drive to keep it "in orbit." What happens is that the second line supervisors, or replacements, do not always share the enthusiasm of the program's author and guiding light. Some of them find it difficult indeed to become aroused over mere pieces of paper. They do their jobs in *routine* fashion. Unfortunately, that is just not good enough. Not only for them (since it bogs them down in a morass of mediocrity from which they may never escape), but for their supervisors, who see the program slowly slipping into oblivion along with their uninspired subordinates.

Then of course, there are those supervisors who decide they "have it made." The program is rolling, everything *seems* okay, so why push any harder? Just drift easily from day to day, handling the job as it comes along. Such a beautiful project can keep going on its own momentum. (Those kind of employees should study the case history of the "unsinkable" ocean liner called the Titanic.)

Malfunctions

All too often this casual approach to the job leads to a slackening-off of service. This is the first ominous sign of a "malfunction in the second stage."

Next comes the failure to keep looking for ways to improve the system. Granted it seemed perfect when you came up with it — but there are always ways to *improve* it. That is what we call "progress" — trying to improve something which *seems* practically perfect. History has shown us that nothing retains its usefulness forever, without change. So you must constantly seek to better your program every way you can, after a careful analysis of it, feature by feature, or risk the chance of obsolescence or inadequacy in its structure.

There are occasions when management itself unwittingly sabotages an excellent system or cost reduction program. This happens when they assume that because such a program has been successfully introduced and has been functioning well since its inception, it will eventually reach a stage where less experienced personnel can be used to run it. Their reasoning is that a routine performance can be handled by a routine performer. The major flaw in this line of thought is that they consider the project *routine*. Nothing so *dynamic* as an important system in a company should ever be considered in that light. It's a vital part of their paperwork operation — and paperwork often spells the *difference* between profit and loss in a company — as well as determining the *size* of the profit.

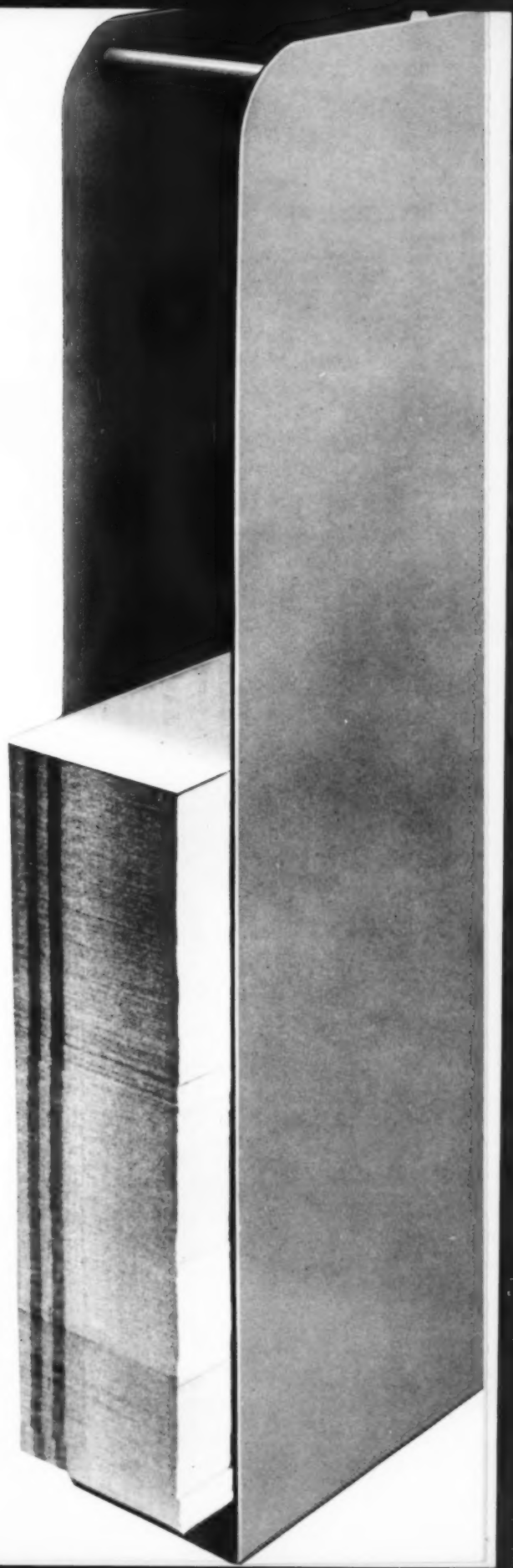
So we discover what has to be done to keep up the momentum of a good installation. Hang on to top flight first and second line supervision. Make sure they keep digging for the "better way." *Never* put the system or program into a "routine" classification. And — approach the system with enthusiasm no matter how well established it is. Such a formula is applicable to *any* undertaking, not only to systems and procedures work, if you wish to insure its success.

THE UNI-TRAY SYSTEM

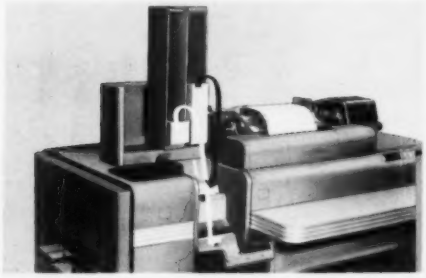
STORES, TRANSPORTS AND FILES CARDS SAVES TIME, MOTION AND SPACE

Full utilization of today's high-speed data processing equipment depends on fast and efficient card handling at both input and output stations. The UNITRAY System is the answer. Here is the only complete card handling system to take care of all needs, from machine processing . . . to physical reference . . . to semi-active or inactive storage.

SAVES MONEY

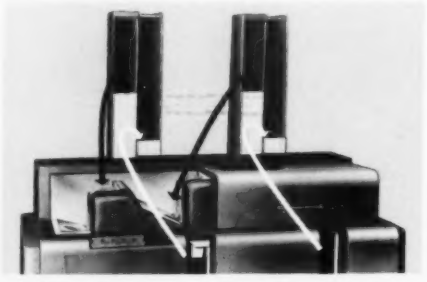


It is no longer necessary to juggle cards by the handful when 3000 can be removed in UNITRAY at one time. Note the ease with which tray is removed from rack.



A simple application, but with trays close by on the floor or in a truck, the speed and ease of the operation is greatly increased.

UNITRAY STORAGE CABINETS hold more than 3,000,000 cards during processing . . . close to machine area.



Feeding trays are reversed for easier handling of cards to be processed . . . all trays concentrated close to feeds and stacker.

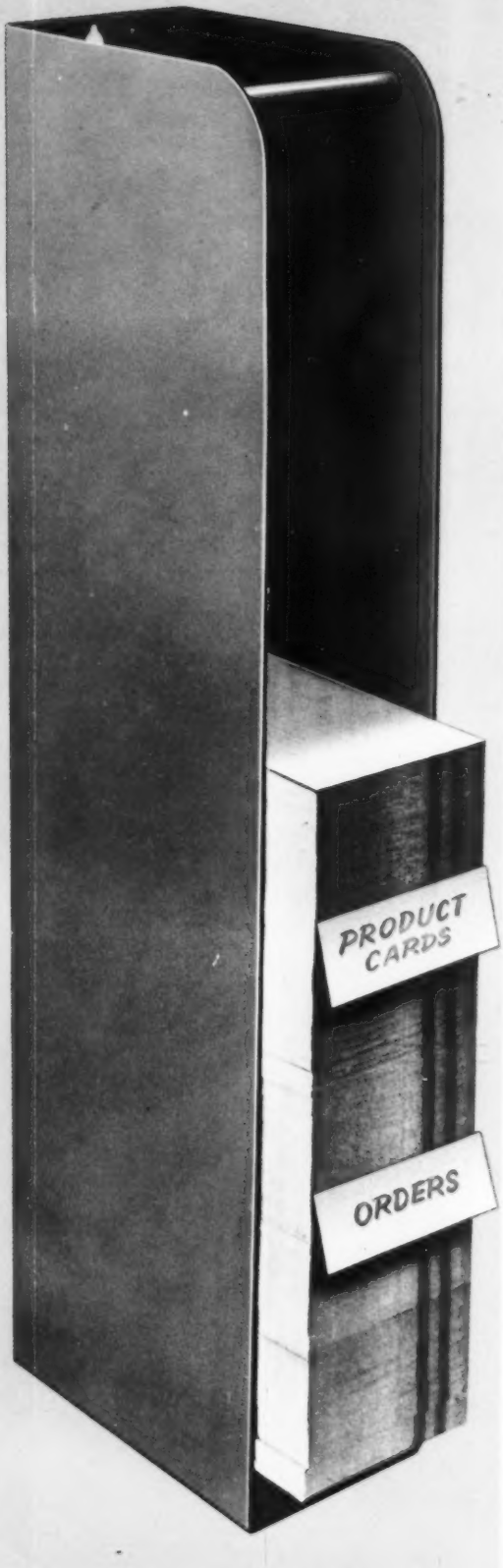
Wright LINE

DATA PROCESSING ACCESSORY EQUIPMENT

WORCESTER, MASSACHUSETTS
DIVISION OF BARRY WRIGHT CORPORATION

Products Sold Exclusively by Our Sales Organization Throughout the United States and Canada.

WHAT IS THE UNI-TRAY SYSTEM?



The UNITRAY System is the only complete card handling system ever developed for use throughout your department.

Each tray is compact, light-in-weight and made for easy carrying. UNITRAY was specifically designed to a length of 22½" to accommodate a workable selection of cards . . . up to 3000 . . . *and still provide* the ultimate in convenience for the operator.

The angle of the tray front holds cards in place and insures *complete card compression* . . . not just top compression. The compressor itself can be adjusted with a flick-of-the-finger through the full range of the tray. Two handed operation is eliminated by this convenient design.

The label area is large enough to clearly mark the details of tray contents. Labels can be slipped in or out quickly and easily through a slotted top. *UNITRAY is designed as a handling tray.*

UNITRAY is a processing tray, too! It's a removable pocket of the sorter rack which can be used on any machine close to feed and stacker. *UNITRAY speeds up processing.*

UNITRAY is a system for use throughout the entire department. It can be used as an individual compartment of a truck . . . a tray in a storage cabinet . . . or as a drawer in a file. All trays are interchangeable to give you the maximum flexibility and save valuable time.

Over 1,000,000 UNITRAYS are in use in more than 14,000 departments throughout the world. That's positive proof of the benefits offered only by the UNITRAY system.

Why not have a card handling survey made of your department? *It's free* and is available through all Wright Line offices. Write today for further details of this exclusive service offered by Wright Line . . . the originators of the only complete Vertical Card Handling System . . . UNITRAY.

Customized painting to match your department or equipment colors is available. Ask your Wright Line representative for details.

Wright LINE
DATA PROCESSING ACCESSORY EQUIPMENT

WORCESTER, MASSACHUSETTS
DIVISION OF BARRY WRIGHT CORPORATION

Products Sold Exclusively by Our Sales Organization
Throughout the United States and Canada.

Printed in U.S.A.

By John McQuiston, Katherine Moticha, and Curtis Miller

Census Keeping

A simplification of this routine job in a mental institution[1]

AS PART OF A CONTINUING RESEARCH PROJECT concerned with determining applications of data processing equipment to administrative and medical problems in a hospital for the mentally retarded, it was decided to ascertain the feasibility of replacing the former method of hand posting changes in a patient's status and location with a punched card system. In a hospital for the mentally retarded, patients only infrequently die or are discharged, but make frequent moves between wards and from resident to non-resident status. Census keeping in our hospital is essentially an inventory problem which involves keeping track of the location of approximately 3,500 patients on a daily basis. The number of moves per day is usually about 50, but around holidays and on weekends there may be as many as 1,200 moves. These are usually visits by the patient to his parents' home. The hand posting system entails full time work by at least one and often two or more clerks.

It was therefore necessary to devise a system that would require a bare minimum of time and would be so automatic that the chance for error would be slight. Because much research is done at the hospital and additional information must be kept for each patient, it was desirable that additional information be kept on the same record (in this case a single punched card) as the movement information. For example, lists may be requested of all Negroes with an IQ over 50 as of a certain date, and it is desirable that this list making be handled expeditiously.

Card types

In the system to be described, a distinction is made between a *census* card and a *change* card. The census card, in addition to identifying the patient, describes his current location and status. His *status* refers to whether he is in or out of the hospital, and if out, for what reason, such as visit, escape, etc. His *location* refers to what ward he is assigned to, for even if a patient is out of the hospital on some type of leave, he is still assigned a home ward. Therefore, patients may change location without changing status, and vice versa. Each time a patient changes either his status or location, a new census card is produced. The former census card, with the movement information added to the old, becomes a change card. The change card now describes two consecutive moves and contains other pertinent information, such as days between moves or length of stay on a particular ward. There may be many change cards for any one patient but only one census card.

The card format for a census card involves only the left half of an 80 column card and contains the patient's case number, name, ward, present status, date of change to present status or ward, and pertinent characteristics such as sex, age, race, IQ, and diagnosis. It is developed in the following manner: A daily list is provided by the wards on all changes in status and/or location. The keypuncher punches from this list the case number of the patient, the date the move was made (constant after the first card and may be automatically duplicated), the patient's present status, and the ward the patient is on, which may or may not change. Because the list is previously grouped by type of move, further reduction in punching is accomplished by automatic duplication. For large groups of cards, only the case number and ward need to be keypunched, a total of eight strokes. The punching is then verified.

The newly punched cards are next collated against the existing census deck, which contains all the rest of the information for a patient. Using an IBM 514 reproducer board, the rest of the in-

[1]Supported in part by the National Institute of Mental Health Grant No. OM-469, Data Processing in Mental Deficiency. Pacific State Hospital, Pomona, California.

formation about the patient is reproduced from the current census cards to the newly punched cards. A second board reverses the process and the new movement information is transferred to the right side of the current census cards. This procedure changes the current census card to a change card containing old and new statuses and locations, and the dates each occurred. The new cards (which are now complete census cards) are then merged with the rest of the census deck and the change cards are merged with the rest of the change deck. Figure 1 shows a plan chart for this procedure. The whole operation usually takes less than an hour. In practice, the change cards are cumulated for several weeks before being merged with the change deck, as the change deck is not used on a regular basis. At the time of merging, the two dates on the card are differenced, and days between changes calculated. An IBM 602 calculating punch is used for this purpose, but it could be done in other ways. The change deck becomes large rather rapidly. We have had nearly 12,000 moves in only nine months.

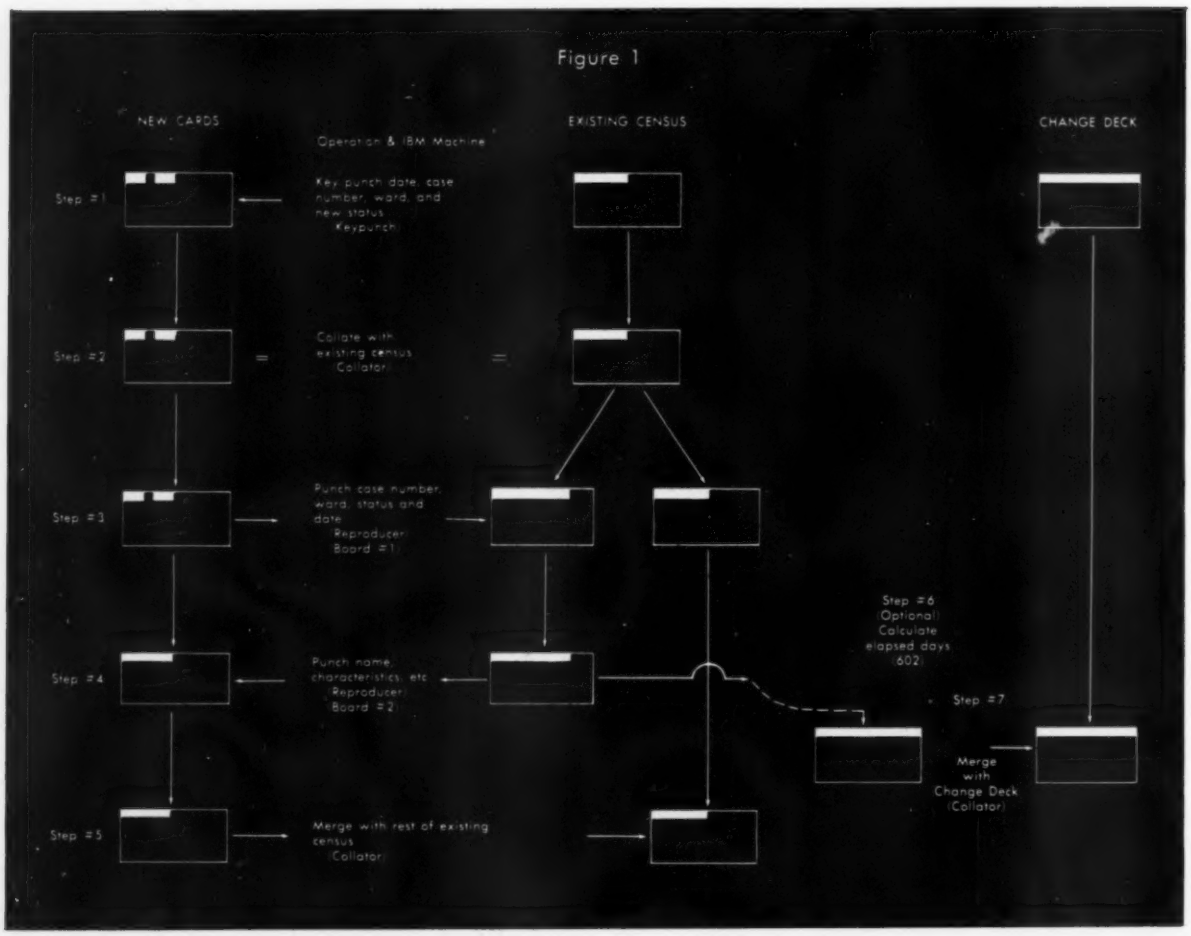
A verification of the accuracy of the system may be made daily by running the flow chart change cards for the day through the IBM 402 accounting machine. From the list containing both old and new information, an inconsistency in status, location, or dates of moves may be spotted at a glance.

Advantages of system

Besides ease in handling and in verification, there are three other advantages to the system. The first is that there is absolutely no hand filing or posting — everything is done with data processing equipment. Secondly, the process does not disturb the existing change file. Cards do not have to be selected at any time from this file, which is a real time saving. Thirdly, with new and old statuses and dates on the change card, ready calculation and punching of data differences in days is possible, yielding much useful information concerning ward occupancy, time on various statuses, etc.

In practice, the system has proved simple and reliable, and has been easily assimilated by anyone who happens to be doing the census keeping on a given day. It has reduced time spent on this particular operation to a minimum.■

Figure 1



Coding Business Data

Efficient codes must be more than historical patchwork

ALONG WITH THE TOTAL SYSTEMS CONCEPT which businesses are considering, we must also think about a total coding concept. The business codes used in a number of firms today are makeshift and patchwork affairs — just like many procedures.

Often a business organization will shy at replacing an outmoded coding system because of the high cost involved. In fact, a major change in an engineering drawing or part numbering system can run to a higher cost than the purchase of a large scale electronic computer. Conversely, a failure to recognize the need for modern, efficient codes to replace awkward, outworn methods can result in excessive processing costs which may seriously impair the advantages of an electronic computer program.

The reason is the historical background of most coding and numbering systems. Originated in the days before anyone thought much about integrated data processing, each department established its own numbering methods to suit its own internal needs, with little or no regard for the effect on the work of other departments. At the same time there was a frequent disregard for future growth, for the efficient use of letters and numbers, and for classification patterns and the use of significant digits.

Almost any company's business data will reveal numerous overlapping, contrary, inadequate, inefficient and incompatible coding methods — all very deeply entrenched. Duplicatory serial prefixes, variable code lengths, conflicting order number series, and quixotic part and operation numbering systems can be found. It seems that the persons who originally set up these codes seldom realized that almost every bit of recorded business data would wind up eventually as a punched hole or an electronic impulse.

To design the best code for a particular application, a number of factors must be weighed. One of the most important aspects is comprehensiveness. How adequate is the code for denoting a number of related, significant factors that will together or separately, at various points of the processing, be required to segregate, classify or summarize the data to produce the desired results? To construct a code that does all these things efficiently calls for deep analysis and broad overall planning.

For example, in a manufacturing enterprise it is customary to set up various coding series to indicate such items as operator, department, job number, part number, operation number, type of labor, etc. Whenever an employee applies labor to the fabrication of a part, it usually becomes necessary to identify the transaction by most of the codes named and sometimes by additional ones. One can readily see that this may amount to as many as 25 or 30 digits of coding, which becomes pretty cumbersome and conducive to error. In an integrated system the coding specialist will attempt, by combining, eliminating or syncopating, as well as by reliance on master data files whenever feasible, to design a code that is as comprehensive, concise, and error-proof as possible.

There are many other factors that affect the design of a code. One of the most obvious, of course, is the length of the code. The more digits provided, the greater the latitude allowed for group classification as well as for expansion. But

By Gibbs Myers

this also makes it more expensive to handle in terms of time and memory, whether machine or human.

Another determination has to be made as to whether letters as well as numbers will be included in the code. Here we run into several paradoxes. Letters would appear to be more efficient, since 26 varieties are available, as opposed to only 10 numerals. But in manual sorting, the use of letters tends to reduce both speed and accuracy, while in machine sorting the letters require double processing. Furthermore, letters mixed indiscriminately with numerals have low memory value and create problems in mechanical processing. However, single or even double letters, used as prefixes or suffixes to a numeric code, can generally be handled efficiently and usually have high mnemonic qualities.

Factors in coding

If we try to distill the essence of a good code we might come up with the following characteristics:

I. Comprehensiveness — adequate to signify all required factors and to classify or extract all required data.

II. Conciseness — as short as possible.

III. Durability — adequate for future growth.

IV. Flexibility — adjustable to meet changed requirements.

V. Facility — easy to code and decode.

VI. Precision — positive identification of the item coded.

VII. Compatibility — suitable for efficient processing by manual or mechanized methods; no conflict with other codes that may be integrated with it.

VIII. Consistency — regular in length and uniform in makeup.

These are not of equal weight and are not necessarily listed in the order of their importance. There is no code in the world that will measure up to 100 percent on all eight of these qualities, but a good code will usually score pretty high on a number of them. As a matter of fact, the relative importance of these qualities depends on the case at hand. If space is limited, then conciseness becomes of greater importance. If you are coding an unstable situation, then flexibility has to be kept uppermost. Any one of the eight characteristics could be the most important in a particular situation.

Basic types

There are five basic types of codes worthy of our consideration, plus several variations that will be mentioned.

First is the *sequence code*. This is the simplest and most compact. It runs from one up. It is frequently used for employee numbering systems. Elsewhere it is usually applied to small groups of items with definite limits or slow rates of expansion, where no need for classification exists. Examples are sales area codes, payroll deduction codes, etc. The sequence code scores well on factors II, VI and VII in the above list.

Next in general use is the *block code*. Under this method a group of like items is assigned a sequence of numbers. Usually a few extra numbers are included in each block for possible expansion. This method is suitable for a fairly static situation such as a simple chart of accounts. The block code registers on factors II, V, VI and VII.

The *decimal code* is probably most familiar to librarians. It has one great capacity — for infinite subdivision and expansion within a minute area. However, because of its lack of conciseness or uniformity of length, it does not make a good code for business data. Its foremost characteristics are items III, IV, V and VI in the above list.

A *mnemonic code* is one that makes use of letters or numbers that represent in some fashion the item being coded so as to aid the memory. For instance, when an office building numbers all rooms on the sixth floor in the 600 series, it is employing a mnemonic coding device. This type of code often constitutes a part of, rather than the whole code. A common example of an extended mnemonic code is the use of such letter combinations as R H B M S (round head brass machine screw), etc. The mnemonic code scores highly only on factor V.

Probably the most versatile device is the *group classification code*. This provides for major and minor classifications of the items coded by utilizing digital significance. For example, in a four digit department number code, using the group classification method, the first digit might designate the division, the second digit the department, the third digit the section, and the fourth digit the subsection. The popularity of the group classification code is due to its logical appeal and competent fulfillment of the coding characteristics designated under III, V, VI, VII and VIII. In fact, this type of code is so popular that it is often applied to situations where a shorter block or sequence code would be adequate.

Significant digits

Significant digits, which can be employed at any position within a code number, are most effective at the beginning or end, or next to a hyphenated division in the code. Their purpose is to provide an additional index to certain items of the mat-

ter being coded, without enlarging or changing the basic code structure being employed.

Final digit coding is a specific method of using the significant digit. It can be employed in conjunction with a block or group classification code. For example, all even numbers could indicate right-hand threads and odd numbers left-hand threads. Or all account codes ending in nine could indicate a certain type of expense that had to be extracted for specific summarization. Or the last one or two digits of the code could be reserved to designate size, weight, or some other physical characteristic.

In the machine processing of data, even the code which this process has called into being may have to be further condensed. For instance, when more space is needed in an 80-column card, every item must come under scrutiny. Perhaps a four-digit field is provided for a code, which in this particular application never exceeds 99 variations. Here, by recoding the code, a two-digit area can be freed for active duty. This is not desirable but sometimes it's the lesser of two evils.

On a more extensive scale, long codes for part numbers, for example, might be completely recoded and decoded by and for electronic data processing. Say the part number is a seven-digit group classification code. The seven digits will provide for a maximum of ten million different parts, but there may be only 10,000 currently in use. To convert these 10,000 part numbers permanently from seven to five digits might not be practical or desirable. But by setting up a recoding and decoding program on the electronic computer it may be possible to eat your cake and have it too. In other words, you can keep your seven-digit group classification code for general use, but occupy only five digits of storage space in the electronic computer program.

Most of these coding patterns have been applied to business data under the conditions mentioned earlier, that is, they were designed mainly to satisfy limited internal departmental requirements.

Now they need to be made more comprehensive to adapt them for use with integrated data processing systems. In some instances the basic structure can be retained, and additional factors can be introduced through utilization of hitherto inactive blocks of numbers through changes in internal patterns, or through the designation of significant digits.

If this cannot be accomplished, then it becomes necessary to study the feasibility of a complete new code design. The cost of this step must be weighed against the additional coding that will otherwise have to be superimposed, and the resultant burden on the efficacy of the data processing system being developed. ■

Coming Events

OCT. 11 - 13
Univac Users Assn. Fall Conference, "Hard Facts about Software".
Warwick Hotel, Philadelphia, Pa.
Contact: Walter Edmiston, Secy. UUA, Philadelphia Naval Shipyard, Philadelphia 12, Pa.

OCT. 19 - 21
Legal and Practical Questions Raised by Computer Use. Joint Committee on Continuing Legal Education of the ALA & ABA.
Pick-Congress Hotel, Chicago, Ill.
Contact: John E. Mulder, Director Joint Committee, 133 S. 36th St., Philadelphia 4, Pa.

OCT. 23 - 27
Electronic Data Processing for Business and Industry.
Hotel Warwick, New York City
Course No. 10, cost $250.00
Contact: Richard Canning
614 S. Santa Fe Ave., Vista, Calif.

OCT. 24 - 25
Computer Applications Symposium, Armour Research Foundation.
Morrison Hotel, Chicago.
Contact: Robert Brausch, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

OCT. 25 - 27
NMAA Western Division Electronic Business Systems Conference.
Long Beach, Calif.
Contact: NMAA Western Division, P. O. Box 7365, Long Beach, Calif.

OCT. 26 - 28
PGED Electron Devices Meeting.
Sheraton Park Hotel, Washington, D. C.
Contact: D.I.M. Ross, Bell Telephone Laboratory, Murray Hill, N. J.

OCT. 28 - NOV. 3
Eighth Institute on Electronics in Management.
The American University, Washington, D. C.
Contact: Lowell H. Hattery, Director, Center for Technology and Administration, The American University, 1901 F. St., N.W., Washington, D. C.

NOV. 1 - 3
25th Anniversary Industrial Engineering and Management Clinic of the Industrial Management Society.
Pick-Congress Hotel, Chicago, Ill.

NOV. 8 - 10
GUIDE INTERNATIONAL User's Conference, IBM 705, 7070, 7072, 7074 and 1401.
Netherlands Hilton Hotel, Cincinnati, O.
Contact: Emerson F. Cooley, Acting Sec. GUIDE, Methods Research Planning and Development Department, Prudential Insurance Company of America, Newark, N. J.

NOV. 8 - 11
Institute of Management Sciences jointly with Operations Research Society of America 2nd American Meeting.
Jack Tar Hotel, San Francisco, Calif.
Contact: IMS, Box 273, Pleasantville, N. Y. or Dr. Paul Stillson, ORSA, 115 Grover Lane, Walnut Creek, Calif.

DeParis on EQUIPMENT —A Monthly Feature

The Bendix G-20 Computer System

JOSEPH R. DE PARIS

THE BENDIX COMPUTER DIVISION of Bendix Aviation Corporation is quietly and gradually emerging as a contributor of importance in the field of computer development. Bendix recognized the value and application for the computer very early in the game and first tapped the market with its well-known G-15 system. The G-15 was initially offered in a configuration best suited to the solution of engineering problems, but since then, with the addition of optional input-output devices, has become a general purpose computer of the low cost, small scale variety. Over 300 G-15 systems have been installed thus far.

Not too long ago, Bendix introduced the G-20 system for high speed, scientific and business data processing purposes. The G-20 is a medium to large scale system with significant features that make it a powerful device capable of competing with the best in its class.

Indications are that Bendix is continuing to expand its line of computers, devices, and supporting services, and intends fully to capitalize on its early start to remain a fixture in the data processing field.

Let's consider the G-20 and see some of its features and specifications. The 20 is a completely modularized system, operates in binary internally, includes a fast central processing unit. All operations involving data transfers and arithmetic are performed in parallel rather than serial, i.e. all the bits of a word are transferred to or from core memory at the same time rather than one at a time. The result is an access time per *word* of only 5.6 microseconds and a memory cycle of 8.4 microseconds per *word*.

Internal memory is core storage organized in fixed word lengths, consisting of 33 binary bits which make up eight decimal digits or four alphanumeric characters. A basic memory module contains 4,096 words, with a maximum of 32,768 words of Central Processor memory available.

An idea of what Bendix means by *high speed* data processing may be gleaned when one considers that the G-20 is alleged to be twice as fast as a 704, five times faster than a 7070, and eighty times faster than a 650. On the basis of price, capacity, and ability, the 20 is competing with contemporary equipment such as IBM's 7070, Honeywell's 800, and RCA's 501 and 601. A card G-20 rents for approximately $7,500 per month, a card and (4) tape system about $13,000 per month.

G-20 library

The program library includes (either available or under development) a Program Assembly System —which is semi-symbolic and absolute; a Symbolic Programming Assembly System—a completely symbolic system; an Algebraic Compiler System; and a Fortran Translator. There is also a 650 Simulator which takes a 650 program and causes the G-20 to operate like a 650, obviously a big advantage in conversion.

Accessory equipment includes line printers capable of 600 lines per minute, 500 character per second readers, and 100 character per second punches for paper tape. Conventional 80 column punched card equipment is accommodated at reading speeds to 800 cards per minute and punching speeds to 250 cards per minute.

Unusually fast magnetic tape units are a feature of the G-20. These units have a read/write speed of 120,000 decimal digits per second and a search speed of 240,000 decimal digits per second. These speeds are among the fastest available with any system.

Extensive expansibility is possible because up to 70 accessories may be connected to the G-20's input-output communication line. In addition, up to six memory communication modules may be added to the central processor. Each has a 4,096 word memory and its own communication line, to each of which up to 70 accessory units may be attached.

Simultaneity of operation is achieved with these added communication channels because each line can allow an input or output operation to be performed independent of the other lines. In other words, up to seven simultaneous input-output operations may be performed. These memory communication modules work in conjunction with central processor memory.

Control buffer operation

Still another feature is an accessory called the Control Buffer, any number of which can be incorporated in a system configuration. Each Control Buffer is really a special purpose processor with its own memory and which can be loaded with its own program. Virtually all a Control Buffer lacks for completely independent operation is an arithmetic unit. Thus, Control Buffers are capable of operating independently of the main memory.

With Control Buffers properly coupled to communication lines, associated input-output units are controlled, following the program of the "CB." For example, the program in the CB may cause transfers of data, such as tape to tape, tape to card, tape to print, while the main program in the G-20 is proceeding simultaneously. A tape search may be directed by the CB program while the main program continues, with the central processor signalled by the CB at the conclusion of the search. The possibilities introduced by this Control Buffer concept are enormous.

It is almost superfluous to comment that Bendix and its G-20 must receive serious consideration by data processing management everywhere. ■

Mr. President:

Here is the first policy specifically created to protect your investment in electronic data processing

It could save your company thousands of dollars!

Two years ago it could have saved the U. S. Government several *million!*

On July 2, 1959, the destruction of some of the Pentagon's electronic data processing equipment and records resulted in enough extra expense (aside from the physical loss itself) to have wiped out even a strongly financed private business concern.

Could it have wiped out or seriously crippled yours?

The question is worth pondering. Especially since there now *is* a way private business can be protected. It's new—brand new—and it comes from The St. Paul.

This new protection—The St. Paul Data Processing Policy—protects your company as no other single policy or plan does. It is, in fact, the one and *only* policy that can and *does* give you the protection you need with these three optional coverages: (1) Pays for extra expenses resulting from destruction or damage to any part of your data processing system whether caused by fire, flood, wind, collapse, theft, water damage or any of many other unusual perils. (2) Pays for costs of reassembly and reproduction of damaged or destroyed records and/or tapes. (3) Pays for repair and/or replacement of damaged or destroyed data processing equipment.

Now, if you lease your equipment, you may think you are covered by the lessor. And, as far as the equipment or certain components are concerned, it is possible that you are for some conventional perils. But perhaps only partially; and perhaps not at all. (And certainly not for *extra expense*, which may even exceed the cost of the equipment itself.)

For your own protection, have your insurance manager, comptroller or company attorney make *sure!*

May we suggest you check into the matter before the end of this business week . . . and mail the coupon below before the end of this day? Just these two simple steps could save your firm not just thousands but literally *millions* of dollars!

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INSURANCE COMPANIES

Serving you around the world . . . around the clock

St. Paul Fire and Marine Insurance Company
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CLIP AND MAIL BEFORE THE END OF THIS DAY

The St. Paul Insurance Companies
Dept. DP-3 St. Paul 2, Minnesota

Please rush full details on the new St. Paul Data Processing Policy and explain how your free inspection and engineering service can help us build an effective security program.

Name_____

Firm_____

Address_____

City_____ Zone____ State____

Circle no. 9 on reader service card.

By Edith Harwith Goodman

Dedication ceremonies at McDonnell for the IBM 7080 go waggish with a special gimmick devised to cut the ceremonial ribbon. At the Automation Center are, left to right, Robert L. Harmon, general manager of the Center; Frank H. McCracken, IBM midwestern regional manager, and William R. Orthwein, McDonnell vice president.

McDonnell Automation Center

Commercial data processing diversifies operations for an aircraft builder

THE VICE PRESIDENT PRESSED A BUTTON. At the top of the large box a pair of scissors ripped through the paper covering of the Electronic Automatic Ceremonial Ribbon Cutter. As visitors watched closely the robot hand closed the blades and made a clean cut of the wide red ribbon extending from the computer console, and retreated back into the box. That took care of any stuffiness usually associated with dedications.

The cutter was devised by personnel at McDonnell Automation Center, a division of McDonnell Aircraft Corporation, for the unveiling of their new IBM 7080 — the first 7080 anywhere.

The addition of the 7080 raised the Center's inventory of analog and digital computer equipment to a value approaching $10 million. This equipment is in the twin complexes used for scientific-engineering and administrative data processing, both for the parent company and for outside firms.

Why data processing?

McDonnell Aircraft, which began business in 1939, has had only one customer — the government — for whom it builds military aircraft and spacecraft (the Mercury capsule is produced in the McDonnell factory). For its own purposes, McDonnell has been mechanizing data processing since 1941, and still retains about 90 pieces of punched card data processing equipment for jobs too small for the computers.

Over the years the company has used equipment such as IBM's 601, 604, 704, 705, 709, Ramac 305, CPC, Burroughs Datatron 204 and E 101, and the Royal McBee LGP 30. With the replacement of smaller equipment, the present setup includes a 705 II (soon to go as the 7080 completely takes over), six 1401s, Ramac 305, two 1620s, 7080, 7090, CEAC and PACE analog computers, and the Datatron.

The Automation Center is divided physically into two sections: one site of 6,500 square feet used for scientific-engineering purposes contains the 7090, analog computers, and other scientific hardware. The administrative data processing site comprises about 4,500 square feet and contains the 705 II and the 7080, some 1401s, with a 1412 coming soon for bank data processing. There is also a punched card section adjacent.

Services

The Center offers four services to outside clients: consulting, systems design, programming, and data processing. Clients presently represent 36 different industries in 13 cities. These industries are diverse; included are communications, finance,

investment, electrical manufacturing, petroleum, publishing, retail, and educational. Applications range from daily inventory and stock market analyses to school scheduling, actuarial studies, and oil refinery simulations. Consulting and systems serve such fields as banking, wholesale and retail distribution.

Some of the work entails assistance to companies wishing to set up their own equipment. These may be customers who grow from having data processed for them to establishing their own data processing department. Another facet is the continual development of new applications for customers with information processed at the Center.

Banking is the newest field for the Center. Many small banks are going to need servicing for MICR accounting, especially in demand deposit accounting, but are too small to venture into their own equipment.

Like Topsy it just grew

In 1957, after two years of preparation, the IBM 705 was installed to initially process the 12,000 employee payroll, labor distribution (a variety of man hour and labor reports), and bill of material summarization reports for procurement. The regular 40 hour week prevailed for equipment use at first but soon expanded to the present 130 hours a week (three shifts, six days a week) with development of new and more complex problems, such as production control.

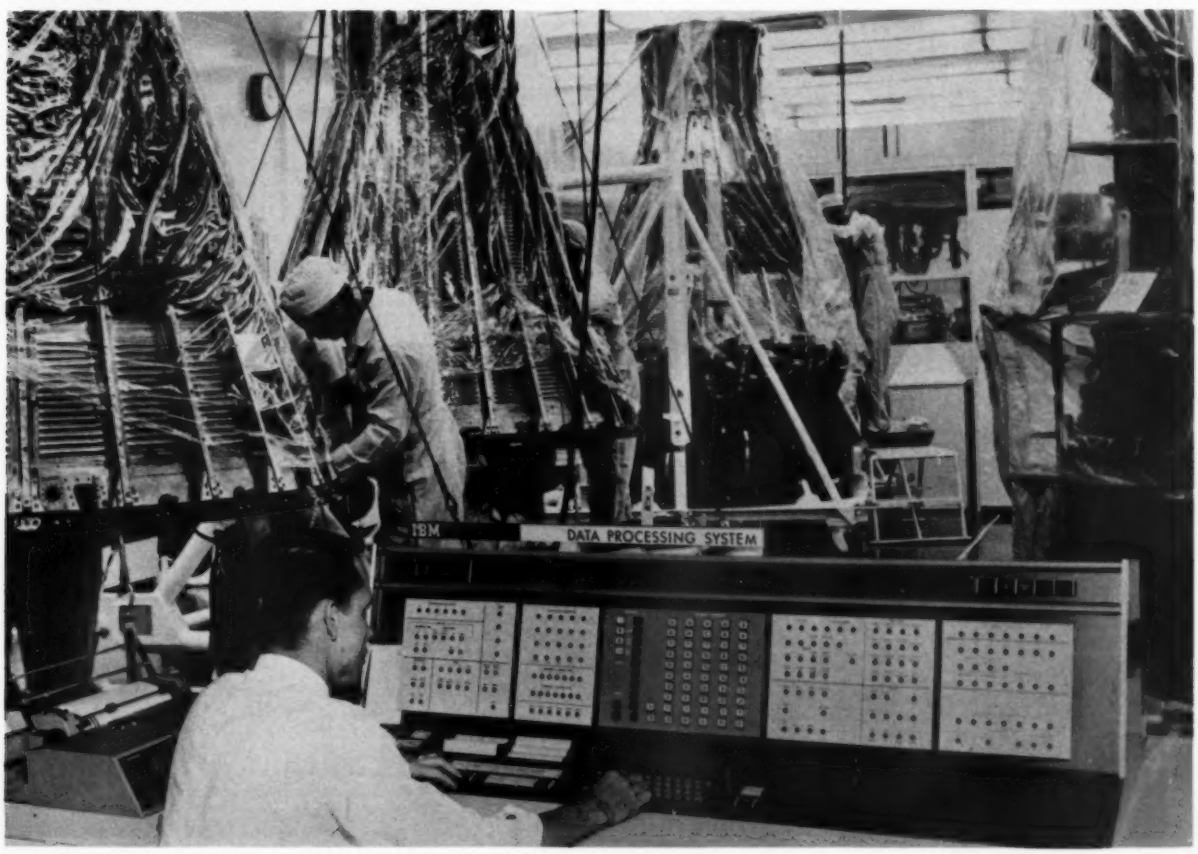
Production control is a series of programs, schedules, and releases which follow up and determine the part requirements for an average of 60,000 production work orders on a day-to-day basis. This gives the manufacturing end good control. For example, all parts for an aircraft such as the F4H Phantom II can be rescheduled in a half hour even though it involves approximately one-quarter million parts and assemblies.

The material requirement series of programs keep track of approximately 800,000 different detailed parts on a weekly basis. Each contract is summarized to include the parts and materials which must be procured in time to meet production schedules.

The inventory programs record the receipts, disbursements and current balance of all production parts and material on a daily basis. This is a matter of controlling 45,000 different items involving 200,000 individual records.

The 7080 is expected to reduce the production

The console of the 7080 is not actually in the shop in front of these Mercury capsules; this composite picture illustrates what the parent company does.



control series of applications from 16.5 hours a day to about 4.5 hours. In another production control series program which involves sorting, the speed ratio achieved is 11:1, reducing one process from nine hours to 50 minutes.

Because the 7080 is faster than the 705 by a factor of 10, the reduction in time needed to process all business, parent and client, will be greatly cut thus allowing the Center to reduce hours and still expand the load of work.

The Automation Center has a staff of 400 for its various services, plus a pool of well over a thousand engineers from the parent company which can be tapped for special efforts.

EVOLUTION OF MCDONNELL AUTOMATION CENTER

DATA PROCESSING			COMPUTING	
YEAR	TYPE OF EQUIPMENT	SPEED* (CALCULATIONS/MIN.)	TYPE OF EQUIPMENT	SPEED* (CALCULATIONS/MIN.)
1941	TAB			
1942	601	15		
1950	604	300		
1952			CPC	300
1952			ANALOG	
1955			650	30,000
1956			DATATRON	30,000
1957	705	294,000	704	2,500,000
1959			709	2,500,000
1960	305**		(1) 1401 (MEDIUM SCALE)	174,000
1960			7090	12,500,000
1961	(1) 1401 (MEDIUM SCALE)	174,000	(2) 1401 (MEDIUM SCALE)	174,000
1961	7080	2,808,000		

*NO. OF ADDITIONS OR SUBTRACTIONS OF 10 DIGIT NUMBERS IN ONE MINUTE
**15,000,000 CHARACTERS OF RANDOM ACCESS STORAGE

Facts about the IBM 7080

The IBM 7080 is faster than the 705 by a factor of 10.

Internal processing speeds — a second:
90,900 five-digit numbers, add/subtract
3,770 ten-digit numbers, multiply
333,000 logical decisions.

Tape speeds: read magnetic tape at 62,500 characters/second.

Magnetic core storage — 160,000 digits alphabetic or numeric; access time two microseconds.

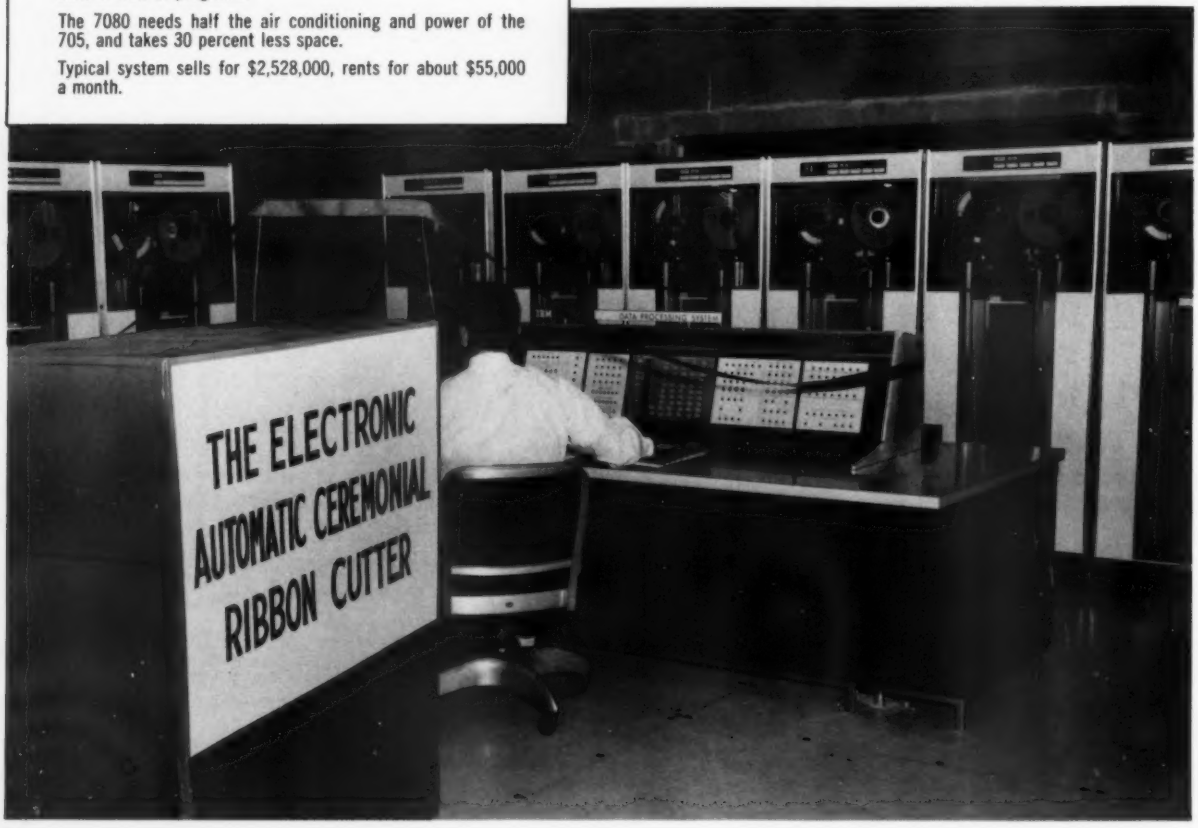
Memory (communication storage) can transfer information between tape units and main data storage at one microsecond a character; five tape units can be reading in or out simultaneously.

Priority processing — simultaneous reading, writing and processing operations. Input and output devices automatically control flow of programs.

The 7080 needs half the air conditioning and power of the 705, and takes 30 percent less space.

Typical system sells for $2,528,000, rents for about $55,000 a month.

Shown are the 7080 console and tape drives. The tape units are 729 IVs, ten times as fast as previous 729s.



Why guess at management figures?

Are you relying on management figures that are *almost* complete? Did you know you can now have CURRENT FACTS at your finger tips to assist you in making decisions?

HOW? Through NCR Electronic Data Processing Systems that provide complete management facts and eliminate costly guesswork. NCR Systems go all the way from the original entry to your desk—from cash register, accounting machine, or adding machine ... through the computer, and the high-speed report printer ... to your final reports.

ADVANTAGE? You can now have all the facts to evaluate every trend ... to control every cost factor ... to forecast every critical condition ... and to eliminate guesswork from every business decision. In short, you get greater executive command ... you get *today's* management facts *today*, in time to be used most effectively.

• Punched paper tape is created by NCR Accounting Machines, Cash • Registers and Adding Machines as an automatic by-product of nor- • mal operation. It is then fed into a computer to produce, at mini- • mum cost, the information you need for most profitable control. •

Circle no. 10 on reader service card.

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NCR National

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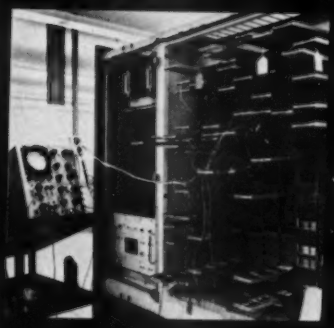
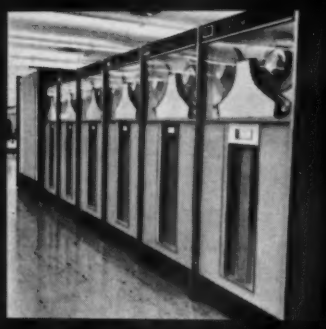
ADDING MACHINES • CASH REGISTERS
ACCOUNTING MACHINES
NCR PAPER (NO CARBON REQUIRED)



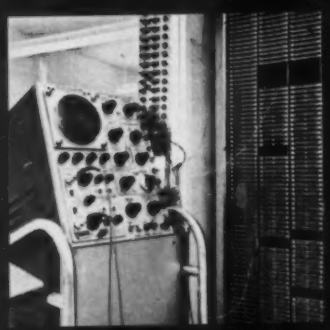


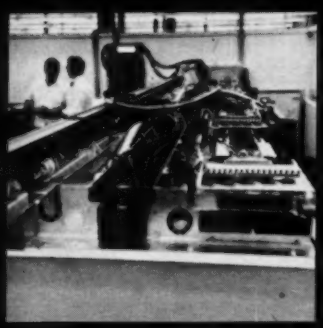





UNIVAC III SYSTEM







Univac in action...

Countdown on Univac III—the world's most powerful large-scale business computer

This is UNIVAC® III. In November 1961, this new computer completes systems test and goes "on the air" as an operating system—ahead of schedule. *Ahead of schedule* because of automated development techniques* perfected by Univac.

UNIVAC III provides more output at lower unit cost than any other system available today. Renting from $18,000 to $22,000 a month, it delivers more power than computers in the $30,000 to $40,000 class!

Its central processor contains enough main memory storage for a program of up to 32,768 commands. And it takes only 4 microseconds—one million times faster than you can read this sentence—to complete a computer cycle. Add time? 8 microseconds.

Need mass storage for large-scale batch data processing? Up to 32 new Uniservo III tape units can be used to meet your requirements. A new character packing technique permits you to store 48 million digits on a single reel of tape—over a billion and a half digits in all.

Looking for speed? This new Uniservo III tape can be read and written at the rate of 200,000 digits per second. Fully modular, UNIVAC III can handle four of these tapes concurrently—*800,000 digits per second.*

Want easier operation? With UNIVAC III, there's a minimum of operator intervention, a minimum of tape change-over. For example, you can read, write, and compute concurrently with up to 8 different input-output operations. A unique multiple program-interrupt feature assures their compatibility.

UNIVAC III also provides "open-end design." Its 8 general-purpose, bi-directional channels can accommodate any new or improved peripheral equipment, on-line or off. They won't compete with the computer.

You get simplified programming, too. A variety of automatic coding techniques is available to suit your needs.

A continuation in design concept of the incomparable LARC computer, UNIVAC III brings you economy and flexibility, accurate performance and high computing speeds. Because of this advanced logical design, UNIVAC III memory can be made to handle bigger jobs if your future needs require it. You just add the necessary memory module.

Only with UNIVAC III will you find all these advantages combined in a single system. Why not call your Univac representative for full details?

*UNIVAC I was used to design, test and prepare all diagnostic programs as well as for backboard wiring layouts during development of UNIVAC III. Software and hardware were produced simultaneously . . . a major factor in the accelerated schedule of this powerful new computer.

Circle no. 11 on reader service card.

UNIVAC

DIVISION OF SPERRY RAND CORPORATION

By Robert V. Lewis

Top Management Participation

Key to a successful electronic data processing program

LET US ASK OURSELVES why we are just beginning to emerge from a period of disappointing and disillusioning experiences with electronic computers? What has happened to that blue sky, cloud nine atmosphere that pervaded our thinking back in the mid 1950's? Why up until recently have we been more impressed by the number of computer installations and types of applications than we have been by the success of electronic data processing systems?

Upon closer scrutiny, the greater part of this disenchantment may be traced to top management's lack of responsibility and involvement in the corporate electronic data processing program. The development of large scale computer systems most definitely requires the attention of top management up to and including the president and perhaps the board of directors. Successful installation of electronic data processing systems demands the definition of goals and objectives by top management and the direct and willing participation of the affected divisions or departments in determining the data processing needs.

Top management must closely associate itself with the corporate electronics program for many valid reasons. Large scale computing systems are not acquired at the cost of a simple ten key adding machine. The rental or purchase price of such a system involves sizable expenditures. The costs of pre-planning and installation are also very substantial. The total cost of the over-all project is usually large enough to require presidential or directorial approval. Previously installed office equipment was often approved by middle management personnel alone.

Changes in corporate policies and practices may be necessitated to optimize the objectives of an electronic data processing program. For example, a policy of almost complete decentralization of management and staff functions may have to be modified to best benefit from the computer's ability and efficiency in handling repetitive, high volume operations. Such decentralized plant or division functions as accounting, billing, inventory, payroll and similar applications may have to be taken away from autonomous units and centralized. Many accustomed practices, such as billing, for example, may have to be dramatically altered to meet the requirements of the computer system. It is changes of this nature that should receive top management's attention.

Changes needed

In an attempt to integrate the data processing function, the work of some units and departments may be completely eliminated, or drastically reduced, while at the same time work flow relationships are seriously altered. Changes of this order are usually resisted, at times vehemently, and the support of the company's executives may be required to effect them. Conflicts of interest will undoubtedly arise and can only be resolved by senior officer arbitration.

Top management must participate in getting the computer program off the ground. Primarily, top management should issue a statement of basic objectives and how they are to be achieved. This will provide a framework of study and recommendation for those individuals who will be personally responsible for the success of the project. If the committee approach is used to initiate the program, the various departments affected are usually asked to be represented. These representatives should be men of proven ability who possess a deep knowledge of company wide systems, opera-

tions and objectives. Often these men are a valuable asset to their department manager and there is a strong hesitancy to lend such men to an electronic committee. Once again top management must step in to keep the program rolling.

Convincing top management to accept an active role in developing an electronic computer program accomplishes nothing if management only does lip service to what was mentioned earlier. Management must help clearly define the goals and objectives of such a program and at the same time must be firmly convinced that there is a basic need for an electronic computer before it is willing to devote the time and money required for a detailed feasibility study of a computer installation.

In the early "blue sky days" some managements went ahead with studies even without any definite idea of what benefits could be expected. Many such companies have dearly regretted their lack of advanced planning and detailed preparation.

Scope definitions required

For maximum effectiveness, the scope of the application should be broadly defined so that most, if not all, of the facets and data processing requirements of the business are encompassed. Little or no benefit is derived by limiting the program to a conversion from punched card procedures to an electronic computing system. Similarly, except in rare situations, application of a medium or large scale computer to the data processing requirements of one department seldom proves economically sound.

Management must keep a finger on the pulse of the project's progress by establishing financial and time budgets for such functions as the survey of the existing system, development of an electronic computer system plan, staffing and training, and finally, selection of the equipment.

Typical of any man-machine system, the human element involved in electronic data processing is often the limiting factor of a successful installation. This point must never be let out of sight. The selection, training, and development of an electronic data processing staff should be of vital concern to management. Despite articles and speeches on traps and pitfalls, management at large has assumed that it had the experience, presumably from previous systems work, to go into an electronic computer program. Accordingly, in many cases, the work has been delegated almost altogether to personnel not properly equipped by training or background to do the job without proper guidance. Once the job is delegated to weak or incompetent hands, management is in for many headaches. The place of the electronic data processing department in the corporate structure must be clearly and definitely defined in the early stages of the program. If the duties, responsibilities, and authority of the computer department are not clearly understood and respected, organizational chaos can result. The electronics committee approach to computer department administration often results in a weak, loosely defined, and ineffective organization. The electronic data processing department should be managed by a mature individual who has a broad understanding of company operations, policy organization, and customs. Experience has proven that a workable knowledge of computers can be more easily acquired than attempting to train a computer technician in the ways of a company's business.

Disappointing results

To date, many large scale computer ventures have been or are unsatisfactory to a greater or lesser degree. This appears to be due to an uncontrollable tendency to mismanage this type of project, probably resulting from underestimating the planning and skills required or from overestimating the value or expectation of other types of experience.

Mismanagement has resulted in disappointing experiences when initial goals and objectives have not been achieved. Two areas in which results have not measured up to expectations are worthy of mention. They are failure to achieve a net savings in costs and lack of any substantial increases in speed and accuracy.

While the message conveyed here is one of realistic conservatism, I sincerely and definitely feel that the future for electronic computers is healthy and bright. We have revaluated our expectations from electronic data processing in a frame of reference which is far more sensible and realistic than existed in the mid 1950's. Computer users, until very recently, set standards of performance which were much too high. The infancy of the field and lack of practical experiences five years ago gave no justification for such Utopian hopes.

Earlier attempts in electronic data processing expected perfection and looked to the computer as some sort of panacea or opiate. Well, the drug has finally worn off and the pain, which is a healthy sign, is helping us to diagnose the ailment. Management's role must be that of the respected consulting physician whose prescription will be followed. This is distinguished from nursemaiding the project, which management is not advised or expected to do. The organization, however, must provide for that type of care, to be given by those directly charged with the responsibility for the computer installation. The honeymoon is over and now comes the period of adjustment and learning to live together. Married life experiences are growing daily and, coupled with lowering appliance costs, the future life for computer families definitely appears favorable and promising. ■

take it from the Governor of Vermont:

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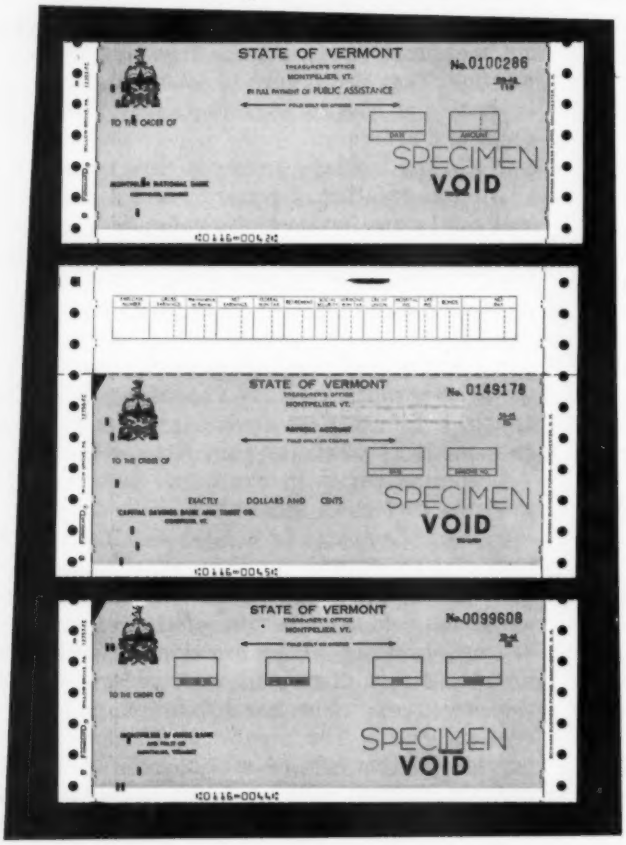

The Honorable F. Ray Keyser, Jr., Governor of the State of Vermont, notes with interest the use of FORMSCARD checks by his Central Data Processing Unit. Checks issued by Vermont's Treasurer's Office, for Payroll, Public Assistance and General Use, are all on FORMSCARDS, allowing for vouchers of any length; side, top or bottom.

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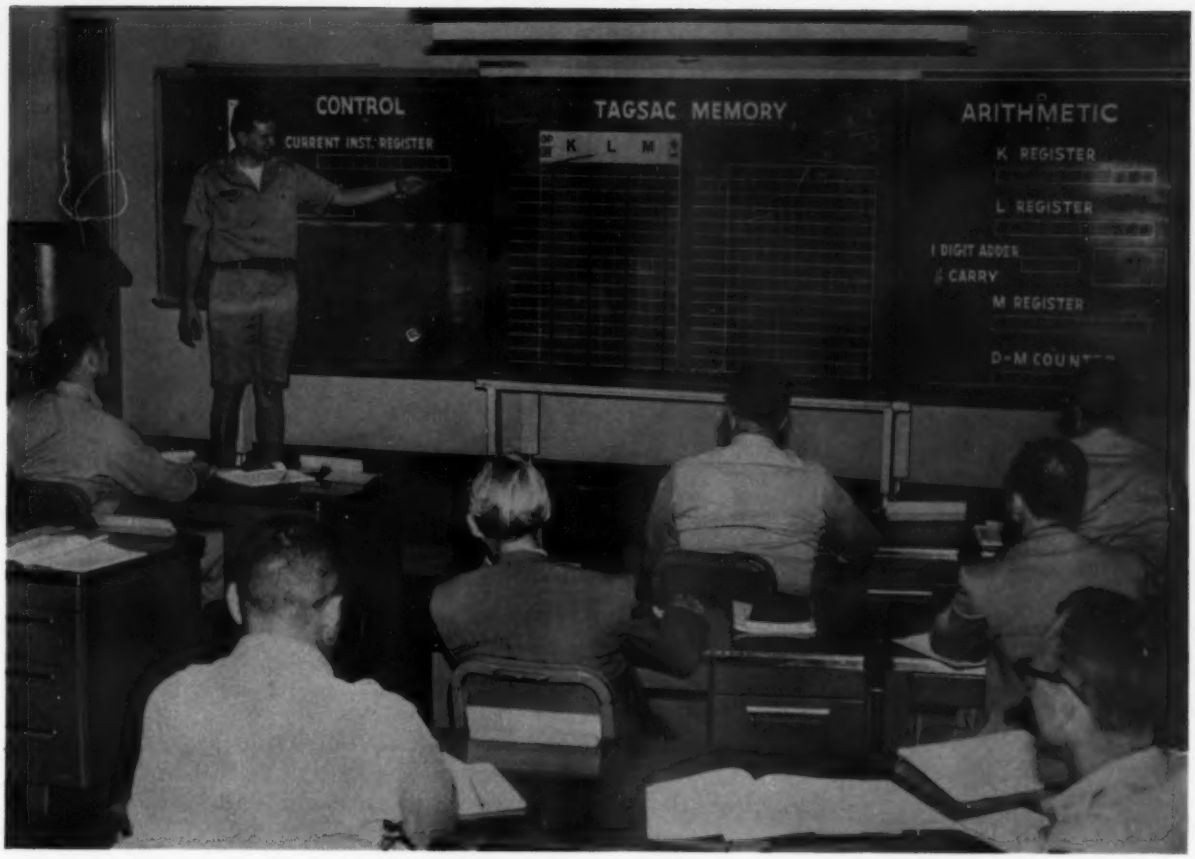


Second Lt. Gerard McLaughlin points out component parts of an instruction word in TAGSAC's memory during an automatic data processing systems analysis class at The Adjutant General's School, U. S. Army, Fort Benjamin Harrison, Indiana. The chalkboard computer is used in more than 25 classes each year.

Simulating Hardware

An answer to teaching without hardware

By Second Lieutenant James A. Joyce

CONDUCTING INSTRUCTION in electronic data processing without a computer is a problem which is faced by many universities and government agencies charged with training students in electronic data processing characteristics and techniques. This was pointed out by Professor Charles N. Moore of the University of Alabama in his article "Teaching without Hardware" in the December, 1960 issue of *Data Processing*.

The mushrooming utilization of computers within the Army and the increased interest in integrated electronic data processing systems have imposed a twofold requirement for instruction of Army personnel and key government employees.

First, the student must absorb new concepts and terminology. The objective of Army electronic data processing systems analysis courses is to train the student in general characteristics and capabilities of computers, relate computer potential to the design of a new system, and ultimately, to serve as the foundation for the student in meeting data processing problems and requirements in his own organization.

The second problem is the unique one, encountered by many universities and at least one Army Service school, of presenting subject matter dealing with hardware without having a computer available. And the absence of an actual computer with which to train students creates still another problem — that of classroom realism.

The data processing department, The Adjutant General's School, U. S. Army, has met the neces-

sity of realism in the classroom and the unavailability of a computer by building its own "electronic" data processing system — TAGSAC.

TAGSAC and TAGSMAC

TAGSAC, The Adjutant General's School Automatic (chalkboard) Computer, and TAGSMAC, The Adjutant General's School *Mobile* Automatic (chalkboard) Computer, have been used since 1958 to orient more than 3,000 officers and enlisted men from all branches of the Army, allied officers, and government civilian employees.

Mounted on wheels, TAGSAC is used in more than 25 classes each year conducted by The Adjutant General's School. It is used as the primary teaching device in orienting students in fundamentals of programming and the concept of the central processing unit of any computer.

TAGSAC stands more than six feet off the floor and is 20 feet long. It contains the three major elements of any central processing unit — internal memory, the arithmetic and logic section, and the control section. Each of these units is composed of its own ruled-off chalkboard, allowing the instructor to enter or erase instructions to the computer and data to be processed. The arithmetic and logic and control sections of TAGSAC are constructed to slide behind the memory unit, allowing the three component parts to be explained one at a time, or permitting the instructor to demonstrate the internal functioning of the blackboard computer by showing the inter-relationship of the three component sections.

Students therefore can see an instruction decoded by the control section, observe "electronic copies" of data being transferred from memory to the arithmetic and logic section, watch the machine calculate results, and see the answers returned to memory.

TAGSMAC, the mobile cousin of TAGSAC, is explained by Captain Donald Kroening of the data processing department, Adjutant General's School. TAGSMAC's component parts are detachable and can be transported whenever courses are to be conducted away from the Adjutant General's School.

TAGSAC is utilized as a teaching device in two ways. The instructor first explains the internal functioning of each section in the central processor. After each section is explained, students are given short programming problems designed to reinforce the instruction they have just received. When each of the short problems is completed a student presents his set of instructions to the class while the instructor records the program in TAGSAC's memory unit. Students thus hear a classmate's solution and also see the instructions in memory. When all programming instruction is completed, students are required to block diagram and program a longer case study and application.

In addition to TAGSAC programming forms and internal memory layout sheets, each student receives an 82-page manual describing TAGSAC's operation codes and internal characteristics.

TAGSAC is a general purpose digital computer which possesses representative characteristics of many modern data processing machines. It is a three address system and contains 1,000 positions of "core" storage. Each word of memory is composed of ten alphabetic characters and a sign. Sign control is algebraic. The arithmetic and logic section of TAGSAC contains a "K" register, "L" register, and "M" register, one-digit adder and carry, and a divide-multiply counter. The control section is comprised of a current instruction register and a location counter.

Orientation device

The purpose of TAGSAC, which is modified as new hardware developments are announced, is not to train personnel as programmers, but to orient students in the general techniques and problems of programming. The major automatic data processing course conducted at The Adjutant General's School is in systems analysis, but it is recognized that systems analysts must be familiar with the capabilities and characteristics of hardware, and a general knowledge of programming principles. To achieve this objective, TAGSAC has been effectively utilized for more than three years.

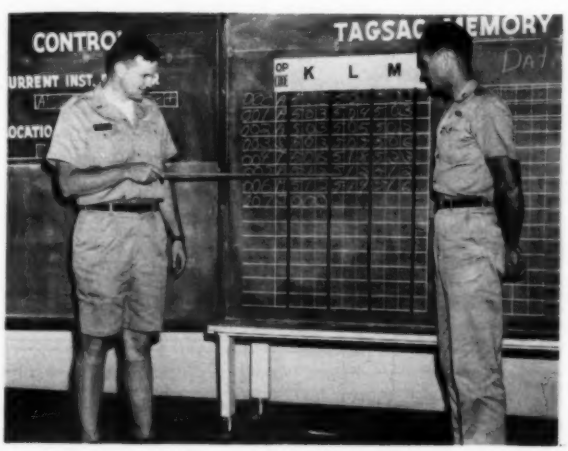
TAGSMAC, the smaller mobile cousin of TAGSAC was constructed with each of its component parts detached for easy transportation. TAGSMAC left Fort Benjamin Harrison, Indiana most recently in March, 1961, and was used in a special one-week class conducted for members of the Officers Assignment Division, Office of the Deputy Chief of Staff for Personnel in the Pentagon.

Beside programming the chalkboard computers, students take at least two field trips each class. One trip is to the U. S. Army Finance Center

where they have been briefed on the applications of an IBM 650 computer and the Minneapolis-Honeywell H-800. Following the briefing, students are taken to the computer site and tour the installation. The second field trip is conducted during the last week of the course and is hosted by one of several users of electronic data processing equipment in the Indianapolis area. These trips generally are made to the Allison Division of General Motors, Delco-Remy Division of General Motors, and to Eli Lilly and Company. Students are taken to the computer sites of these companies and the various applications of the machinery are explained in detail.

Besides providing the necessary classroom realism, TAGSAC has been found to alleviate fears or apprehensions of some students confronted for the first time by an actual computer. Students who learn programming techniques with TAGSAC are not distracted by wildly flashing lights or confused by registers they cannot see. The entire internal "circuitry" of TAGSAC is displayed before them and the instructor can step students through routine internal functioning principles. When the student has learned the purposes of TAGSAC's arithmetic and logic registers and the current instruction register and location counter found in the control section, he can more easily understand the messages of a console on an actual piece of hardware.

A growing need for an actual computer is encroaching on TAGSAC's preeminent domain at The Adjutant General's School with the increasing requirement for more detailed training in all aspects of computer utilization. In the interim, this unique training device, designed in 1958 by personnel in the data processing department, has served well in creating classroom realism and filling the breach of teaching without a computer.



Lt. Col. Charles E. Blount, director of the data processing department, listens as Lt. Gerard McLaughlin explains a short programming problem. The instructions are entered in chalk into TAGSAC's "memory" and easily can be changed by the instructor.

By Van B. Thompson

PERT

Pro and con about this technique

ELECTRONIC COMPUTERS have been used for many purposes in their short history. Initially, they were used for solving complex mathematical problems, a use that continues today in a dynamically expanding fashion. Then, computers were put to work handling large volume business data processing jobs, involving a great number of simple arithmetic and logical operations. A good deal of the present growth of business usage of computers continues to be in these high volume jobs requiring little in the way of sophisticated mathematics. The greatest impact of computers in business, though, is apt to be felt when they are used as a tool by which advanced mathematical techniques are applied to business problems. PERT (Program Evaluation and Review Technique) may be a crude but effective forerunner to a series of very sophisticated business computer applications.

PERT is not a computer, or even a computer program: it is a technique or scheme, most applicable to control of research and development projects, which can be expressed mathematically and, therefore, programmed for computer processing of schedule data. Developed as a means of controlling and planning the Navy's Polaris weapons program, the PERT method uses probability theory and linear programming to analyze and correlate a multitude of tasks which are parts of complex projects. For all of that, though, PERT is a simple technique, consisting of the following elements:

1. Project analysis and charting
2. Time estimates
3. Computation and report writing
4. Review, control and updating.

Project analysis and charting

Basic to the PERT method is an exhaustive and detailed analysis of what tasks are required to accomplish a project. During a visit to the Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio, where much of the background material for this article was gathered, a number of people working with PERT told the writer they felt this requirement to be the chief (and considerable) value of the Air Force's PERT program, since the use of PERT forces contractors to examine and chart their planned operations thoroughly and methodically.

Suppose you intend to design and

EXHIBIT 1—PERT input reporting form

PAGE OF PAGES

TYPE, MODEL, SERIES NUMBER	PROGRAM EVALUATION PROCEDURE REPORT	Form Approved Budget Bureau Number 21—R308 CLASSIFICATION
FROM: (Name & Location of Contractor)	TO:	FLOW CHART NUMBER / CONTRACT NUMBER / REPORT PERIOD FROM: TO:

FOR ARDC USE ONLY	ACTIVITY IDENTIFICATION		TIME INTERVAL ESTIMATES			COMPLETION DATE			REMARKS
	BEGINNING EVENT NUMBER	ENDING EVENT NUMBER	OPTIMISTIC [1] (Weeks)	MOST LIKELY [1] (Weeks)	PESSIMISTIC [1] (Weeks)	MO	DAY	YR	
A	B	C	D	E	F	G			H

SIGNATURE OF RESPONSIBLE OFFICIAL	DATE SIGNED	CLASSIFICATION

[1] Columns D, E, and F. These estimates should be given for the full activity even though the activity has already started.

build a new type of mousetrap (a better one, hopefully). An analysis of what steps are required to do this might show that you need to accomplish all of these activities:

1. Program go-ahead
2. Complete plans and specifications
3. Secure materials
4. Complete frame
5. Complete trap mechanism
6. Complete assembly
7. Secure test mice
8. Complete field tests
9. Unveil mousetrap (modified).

These steps would be charted in network form, using arrows to show activities that must be performed, and circles to show those points in time (called "events" in PERT terminology) when one or a series of related activities are completed. A PERT network for Project Mousetrap would look like *Exhibit 3*

Time estimates

Of equal importance to the quality of project analysis is the quality of the time estimates assigned each activity: most likely, optimistic, and pessimistic (m, a, and b, respectively, in formulas used to compute with these times). These time estimates are expressed in weeks (and fractions). The most likely time represents the judgment of the person best qualified to estimate the probable time required under reasonable conditions. The optimistic time is that required if everything goes perfectly; the pessimistic estimate assumes everything goes wrong that can. The chances that the activity could take more time than the pessimistic estimate, or less time than the optimistic, should be 100 to 1.

The network for Project Mousetrap, with time estimates added, might now look like *Exhibit 4*

Computation and report writing

When the network has been completed to this point, the data it contains are recorded on a form (Exhibit 1) usable as a source document for key punching prior to a computer run. The first calculation is of an activity time for each activity, solving $\frac{a + 4m + b}{6}$. The activity time thus is weighted to reflect the degree of risk revealed in the three time estimates, and is the basic unit of time used in the PERT method. Our network, with calculated activity times shown, now looks like *Exhibit 5*

The most critical path through the network is found by adding activity times through each possible path from the first to the last event. In our case, the path from event 1 to 2-3-5-6-8-9 is the critical path, requiring 17.8 weeks. Path 1-2-3-4-6-8-9 is almost as critical (17.3 weeks), while path 1-7-8-9 requires only 5.7 weeks.

A statistical variance for each activity is then found by solving

$$\left(\frac{b-a}{6}\right)^2$$

The result is an indicator of the degree of uncertainty of the time estimates for each activity. Additional calculations will show the amount of slack time available at points along each path (none on the critical path) and, by using a start or finish date, convert the times on the network to earliest and latest start and finish dates for each activity.

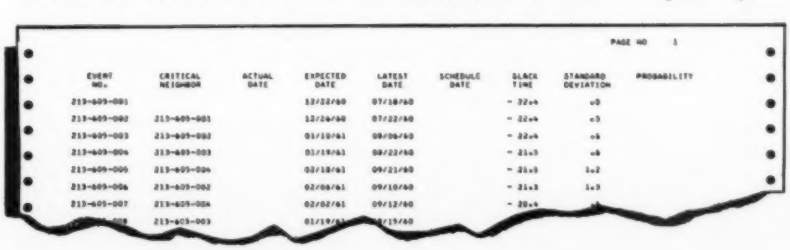
Computer output may then be sorted for printing in any of a number of sequences — event number, slack time, expected completion date, and so forth.

Review, control, and updating

The PERT reports resulting from a computer run (Exhibit 2) are intended to assist management in the

(continued on next page)

EXHIBIT 2–A PERT output report



EVENT NO.	CRITICAL NEIGHBOR	ACTUAL DATE	EXPECTED DATE	LATEST DATE	SCHEDULE DATE	SLACK TIME	STANDARD DEVIATION	PROBABILITY
213-609-001			12/22/60	07/18/60		- 22.4	±0	
213-609-002	213-609-001		12/26/60	07/22/60		- 22.4	±0	
213-609-003	213-609-002		01/10/61	08/06/60		- 22.4	±0	
213-609-004	213-609-003		01/19/61	08/22/60		- 21.3	±0	
213-609-005	213-609-004		02/18/61	09/21/60		- 21.3	1.2	
213-609-006	213-609-002		02/06/61	09/10/60		- 21.3	1.3	
213-609-007	213-609-006		02/02/61	09/12/60		- 20.4		
	213-609-003		01/19/61	08/15/60				

planning and control of one-time or first-time projects by pointing up probable future trouble areas and showing where resources may be available to help ease the load in critical tasks of a complex project. Current Air Force contracts call for reporting by major contractors every two weeks, using the PERT system. Basic PERT computer output reports are produced in about a week at Wright-Patterson, using an IBM 7090.

PERT or critical path method?

While PERT and the Critical Path Method (CPM) are very similar, there are major differences. PERT is designed for research and development type projects, where resources are held constant and time becomes the variant. CPM, useful as a production scheduling tool, is characterized by the fact that time is constant (only one time estimate is used, as opposed to three in PERT), and resources are varied in order to meet the schedule.

How valuable is PERT?

There are some problems involved with PERT which have served as stumbling blocks to its wholehearted acceptance by r & d project managers. Some of these problems may be academic as far as Air Force contractors are concerned, since PERT will be required in all future major Air Force r & d contracts, but they are presented here nonetheless.

First, the reliability of PERT results is open to question, since the bases of this highly formalized technique are some very crude mathematics. The fact that, in the Air Force's case, PERT is generating better results than former reporting and analysis methods has an im-

(continued on page 44)

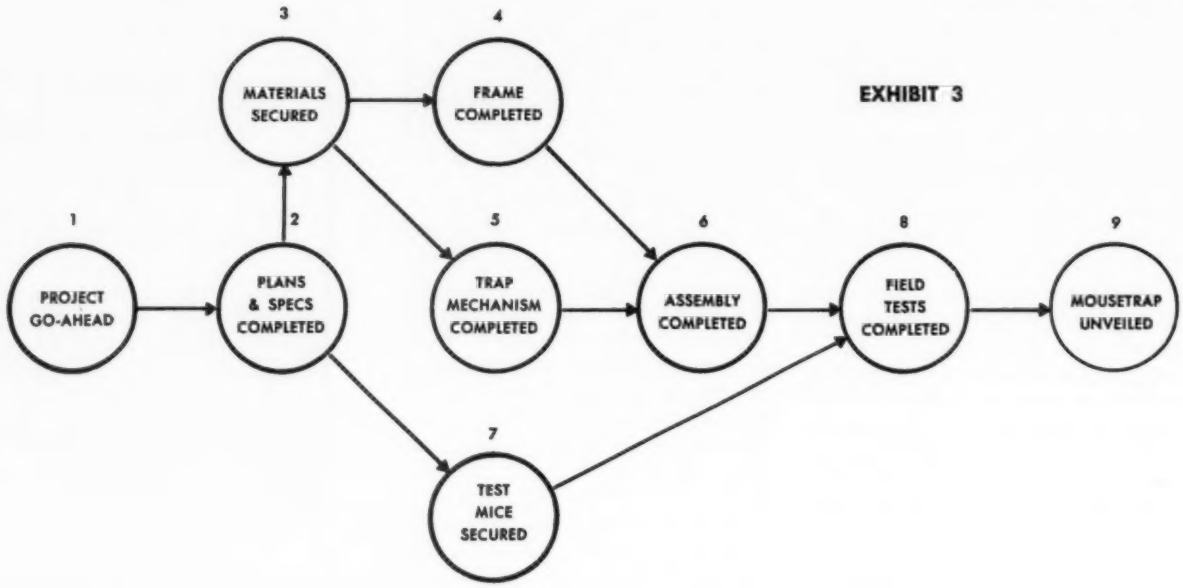


EXHIBIT 3

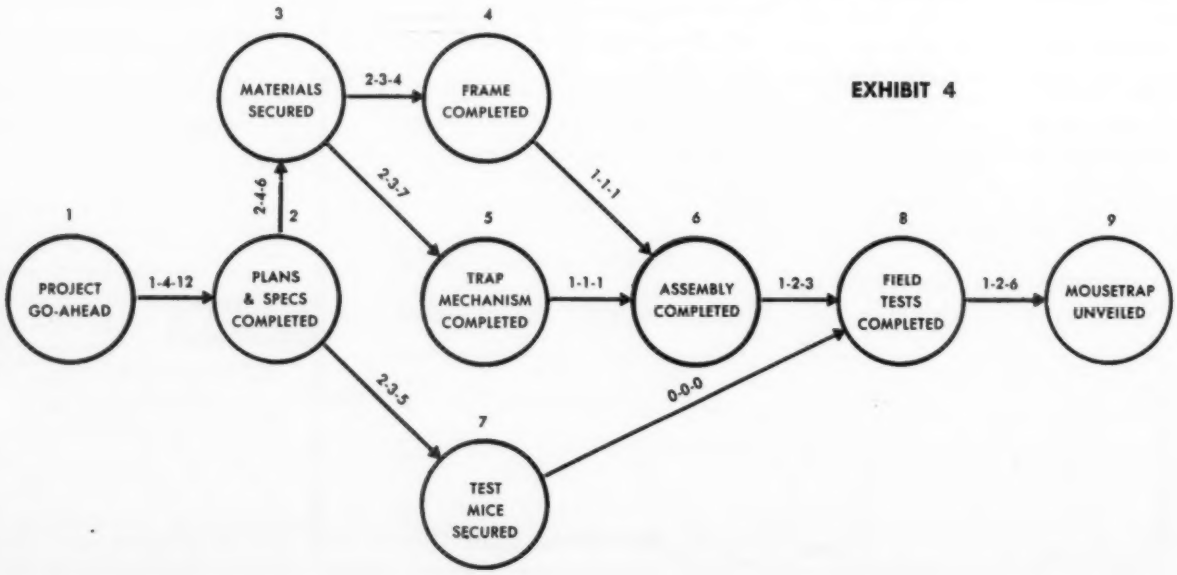
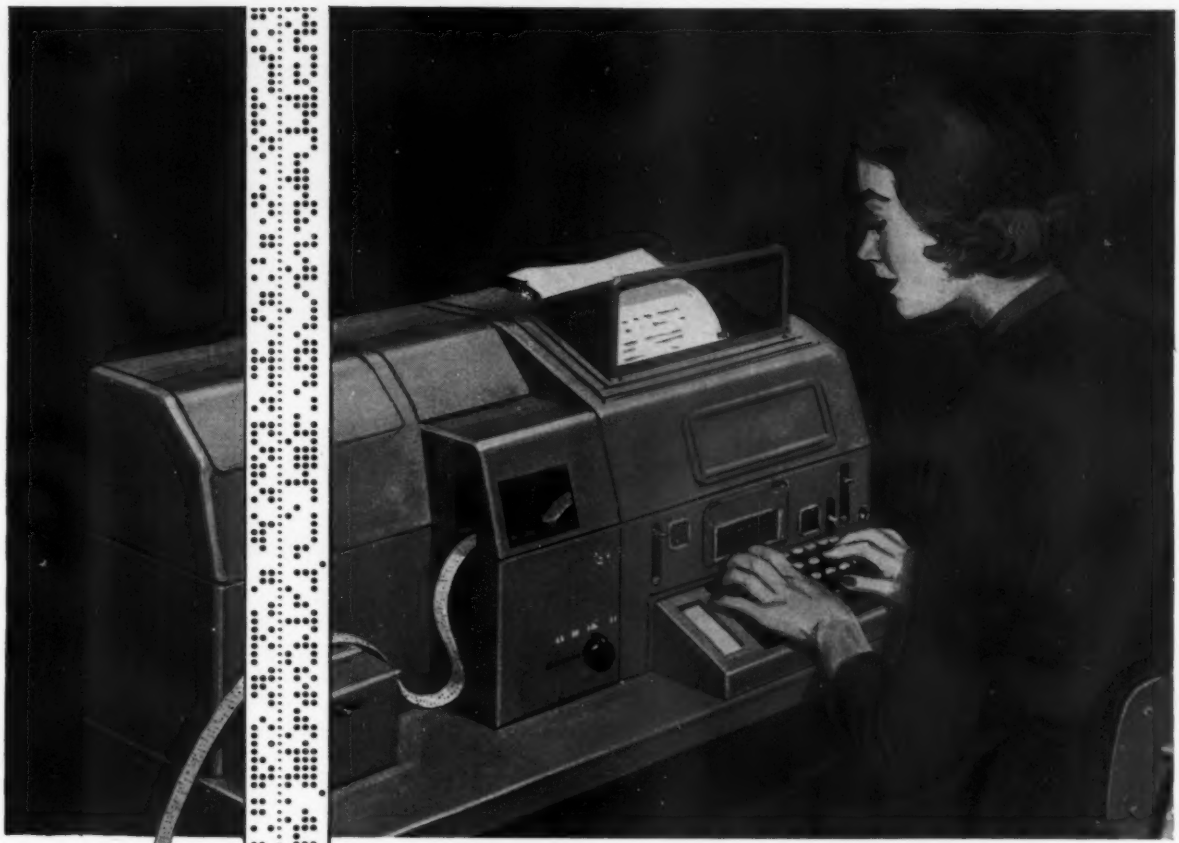
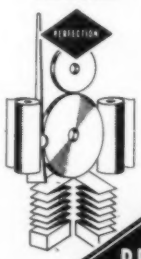


EXHIBIT 4



PERFECTION IS YOUR PROTECTION



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portant bearing on this question; but it would be a mistake to expect too much from PERT in its present state.

Secondly, while the math may be simple, expert programmers at Wright-Patterson testify to the fact that the logic is tough, requiring a relatively large program. Also, computer memory is needed on the order of about six positions for each activity in the network, if the whole problem is to be loaded and run at one time. This can be a formidable problem in a project the size of Dyna-Soar, for instance, where about 30,000 activities are anticipated in the final network. If ample memory is not available, a PERT run must be done in sections at a substantial increase in computer time.

Finally, some note should be made of the fact that this simple technique has generated PERT experts, PERT programmers, PERT manuals, PERT offices, PERT terminology, and many other trappings. Since PERT — when stripped of those trappings — is really a commonsense method of controlling a project, one may well ask what all the fuss is about, and suspect a certain amount of the attraction of PERT is simply that it is in vogue.

At any rate, PERT is here to stay. How long it stays will probably depend on whether or not it is ever developed into an advanced — and reliable — mathematical tool. ■

COLLEGES AND UNIVERSITIES REPORT

The information obtained in a recent survey by Gille Associates for *Data Processing Annual,* Vol. 3 (August, 1961), shows that the colleges and universities have grown apace in their offerings of data processing courses and computing centers. There were 330 respondents to a 500 questionnaire mailing. Of these respondents, 219 offered courses in the field. There were 169 respondents showing either a computer center, laboratory, or department. Among these were 138 commercial computing machines (plus five colleges which indicated that they built their own computers, plus a number which used outside facilities by arrangement with local business).

The machines included:

Alwac III E	2
Bendix G15	6
Burroughs E101	2
Burroughs 205	7
Burroughs 220	6
Control Data 1604	1
IBM 610	3
IBM 650	57
IBM 701	1
IBM 704	6
IBM 709	3
IBM 1401	1
IBM 1620	5
IBM 7070	2
IBM 7090	1
IBM Ramac	4
NCR 102D	1
NCR 304	1
Remington Rand 120	2
RR Solid State	3
RR Univac I	5
RR 1103	4
RR 1105	2
Royal McBee LGP 30	12
Royal McBee RPC 4000	1

Courses offered include credit and non-credit, undergraduate and graduate level, and on campus or extension.

This survey indicates that in the past half dozen years academia has become aware of the surge of interest in the field of data processing and computing in its many phases. Some of these colleges offer degrees in the field; some who now do not offer courses indicate an interest in offering courses in the next year or two.

There is no doubt that the Soviet interest in the field and the competition in the Cold War, Space, and other political considerations have drastically affected the growth of interest in all aspects of data processing, research, and allied engineering fields. All the activity in the field has created so much more paperwork that it cannot be conquered without machine use. The demand for trained personnel in the field has created a demand for knowledge from people wishing to enter or continue forward in careers in data processing and computing. So the colleges and universities have opened their training and research facilities to meet the demands. ■

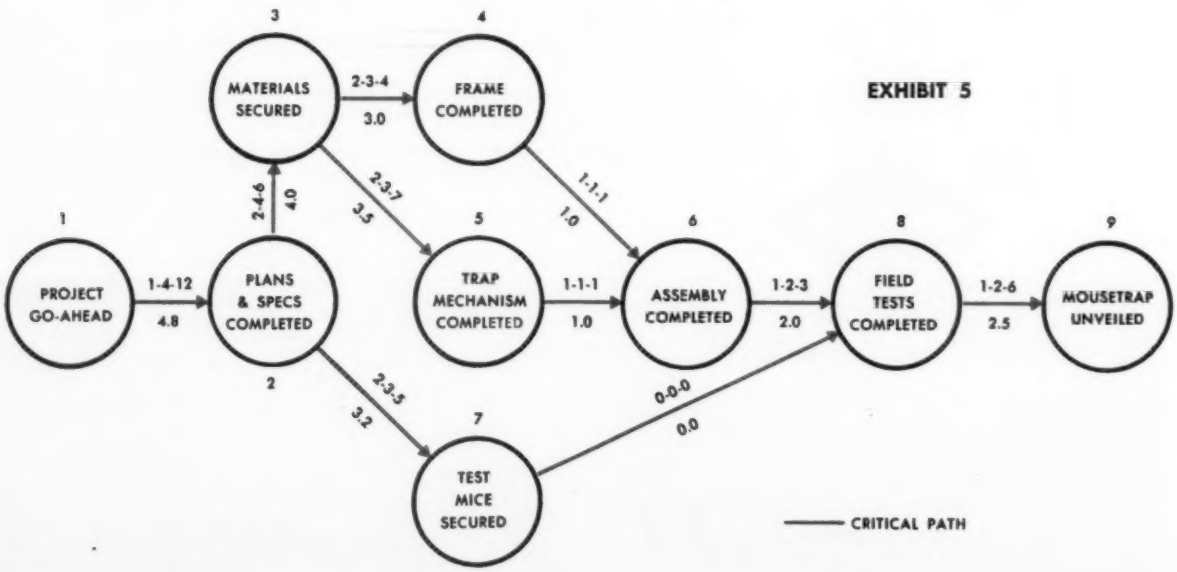

EXHIBIT 5

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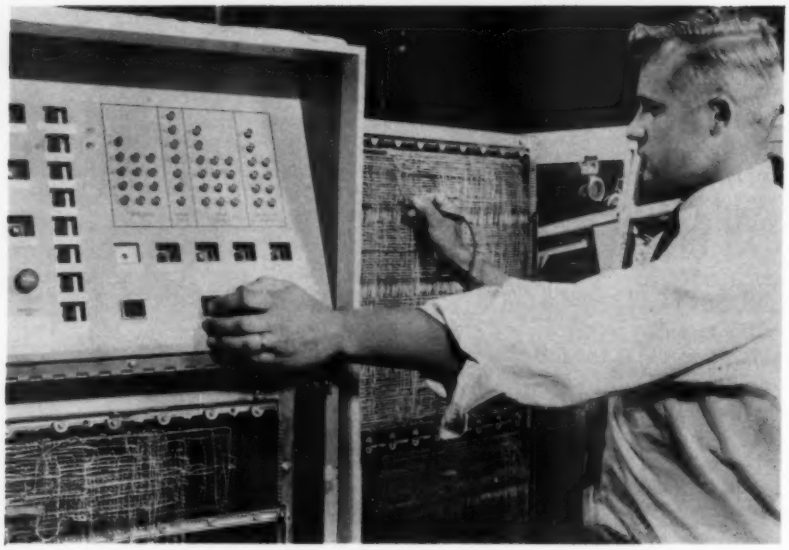
BURROUGHS 200 SERIES

On September 19, Burroughs Corporation revealed its entry into the punched card computer field with the 200 series of moderately priced computers. This series includes the B250, 260, 270 (announced earlier this year) and the 280.

All use the B200 central computer, modified according to the system to accommodate various configurations of input/output devices. There are 4,800 character positions, alphanumeric core storage. Each position, individually addressable, contains seven bits. There is odd-bit parity checking. Instructions are 12 characters in length, three address, 28 instructions to a field, with a maximum of 24 instructions for one system at any time. Data fields are variable; as many as 120 positions may be transferred with one instruction. Arithmetic operand fields can be up to 12 characters in length. Comparison indicators facilitate testing for a high (plus or greater than zero), equal (zero), or low (minus zero) condition which results from the execution of arithmetic or compare instruction. Average instruction time is nine milliseconds. Commands are executed sequentially, unless a branch is initiated.



Each completed central processing unit of the B200 series systems undergoes a comprehensive system check out before release from the Pasadena manufacturing center. The West Coast division was responsible for research and electronics design of the B200 systems.

NEW EQUIPMENT

The configuration of peripheral equipment used with the central computer marks the difference between the various systems, each of which is designed for specific jobs.

The B250 combines high speed punched card data processing with ledger cards. A typical 250 consists of the central computer, a record processor, a card reader, a card punch, and a printer.

The B260 is the punched card computer system, combining in a single run much of the collating, calculating, summarizing, summary punching, and printing which require multiple runs on conventional punched card equipment. A maximum system consists of the B200, two card readers, a card punch, and a printer.

The B270 reads and sorts MICR encoded documents, tape lists on paper tape and writes data on magnetic tape for subsequent computer input. It consists of the electronic sorter-reader, a card reader, central computer, two six-tape listers, and a magnetic tape unit.

The B280 system adds magnetic tape to the 260 system. It consists of central processor, two card readers, a card punch, a printer, and six magnetic tape units, as a maximum.

New features

All systems accept two card reading units, the first of the small-scale type to do so. The card punch can operate at 300 cards a minute. A new clutch allows demand card feeding to hasten execution.

Internal buffers store data from input and feed into the central computer, also out of the processing unit into the output units. This breaks time lags between the faster processing speeds and slower peripheral equipment.

Library available

The series comes with a library of major software available with systems, and a report generator.

This generator is the first to use only a single form, encoded in report oriented terms. It acts on routine reports as well as special and nonrecurring. Specifications for the report can be entered on the form, keypunched onto cards and fed into the computer to produce an object program in less than 30 minutes. It takes only three minutes from generation to object program completion. The report generator also performs a completed logical edit of all specifications in addition to printout of error messages.

Other programs include a magnetic tape verifier, two editing programs,

(continued on page 50)

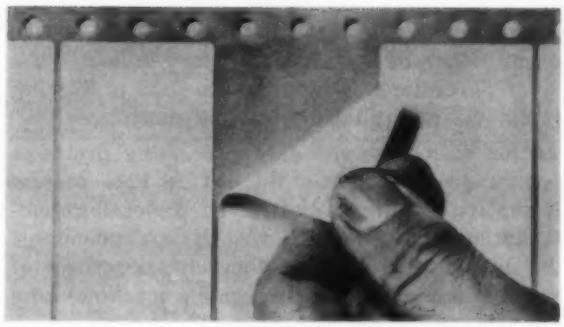
HOW AN INEXPENSIVE SELF-ADHESIVE LABEL ADDS NEW VERSATILITY TO DATA PROCESSING EQUIPMENT

"We first used Tabulabels for a simple, short-run mailing project. Now we know how many other valuable uses for these pressure-sensitive pin-feed labels can grow out of one small initial order."

The above Tab Supervisor's comment highlights an interesting trend in the EDP field. From the day Avery Label Company originated self-adhesive pin-feed labels for use with high speed forms tractor or pin-feed platen equipment, Tabulabel applications have steadily multiplied.

Avery credits its sales success to the inventiveness of Tab Supervisors. Data Processing people, intimately acquainted with their own needs, have created countless uses for versatile Tabulabels in coding, filing, addressing and indexing.

One customer uses Tabulabels for all mailings to customers, stockholders, vendors and employees. This same company uses Tabulabels to handle data revisions with an automatic typewriter linked to their card punch equipment – whenever a card is re-punched with new data, the changes are automatically typed on a Tabulabel for easy application to visual records. They also use Tabulabels to reclassify merchandise during inventory, to revise part numbers, and even to make revisions in their operating manuals.



Tabulabels are the original self-adhesive pin-feed labels for high speed EDP use. They are made of high quality, pure white, smudge-proof stock that assures clean, crisp appearance of all print-out data. They are easily removed from the backing paper for application to any clean, dry surface with finger-tip pressure. Tabulabels are available in 12" fan-fold and continuous roll form.

Tabulabels are convenient

One of the major factors behind the run-away success of Tabulabels is their simplicity of use and convenience in handling. Slow, laborious hand typing is avoided. Expensive, plate-type printing methods are virtually eliminated. Duplication of effort in data transcribing is avoided – any information existing on punched cards or tape can be transcribed using existing print-out equipment, at normal machine speeds, and without error. And Tabulabels are easy to apply at speeds up to 3,000 per hour using Avery's semi-automatic dispenser.

Tabulabels are manufactured under Avery's exacting quality control methods – pin-feed holes are punched cleanly to avoid "confetti." Special packages protect pin-feed edges to avoid "dog ears" and bent or torn margins.

"TABULABELS" is a registered trademark of Avery Label Company

AVERY LABEL COMPANY
A Division of Avery Adhesive Products, Inc.
1616 South California Avenue, Monrovia, California

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SEEN IN PRINT

DATA PROCESSING CENTERS AND THE CPA, by Ralph F. Lewis, Journal of Accountancy, July, 1961.

This article is based on a report prepared by the American Institute of Certified Public Accountants' committee on data processing centers, of which Mr. Lewis is chairman. It is an analysis of the economics and feasibility of doing write-up and statistical work of a CPA firm on punched card and computer equipment, either in the firm's own installation or at a data processing service bureau. Much of the article is also devoted to the use of paper tape as input to the data processing system via tape punching adding machines.

After discussing the data processing problems peculiar to CPA firms, the article lists several alternative solutions and seven general recommendations. These are followed by two appendices. The first gives cost and other characteristics of five makes of tape punching adding machines, and discusses the use of this equipment more thoroughly. The second appendix gives prices and limited specifications for four small computers (Bendix G-15, NCR 390, IBM 1620, and LGP 30); discusses the costs of punched card equipment; and then develops the interesting opinion that in a typical CPA firm's situation — given a minimum of 215 to 220 clients having an average of 300 monthly transactions each — the monthly data processing costs (about $3,000) would be roughly the same if a service bureau were used, if the firm operated its own punched card installation, or if the firm operated its own computer.

PERT/PEP PLANNING AND PROGRAMMING ON EAM, by Tom T. Matye and Glenn K. Rich, Journal of Machine Accounting, July, 1961.

A reprint of a presentation to a joint U. S. Navy Special Projects Office and Contractors meeting, this article was written by the chief of data processing and the head of program report systems at the Aerospace Group, Hughes Aircraft Company. It is cited here for both the usefulness of the material and its completeness.

PERT/PEP is a system by which a company may exert a reasonable amount of control over its research and development program, through scheduling and monitoring of projects. Many government agencies and private corporations have been using this planning aid, but these organizations have commonly run PERT/PEP programs on large scale computers. ■

NOTABLE QUOTES

"How has English language programming (computer English) reached the position of importance it now occupies in programming technology? Sad to say, I believe this has happened because most of the people who have to make decisions about the purchase of computer equipment for commercial use do not have the faintest idea what they are doing. (This is because the computer business is so young that hardly anyone has yet had time to move through a work experience of practical programming into a position of executive responsibility.) To them, the illusion that by obtaining a computer with an associated English language compiler they can avoid selling their company down the river to a bunch of technicians has enormous sales appeal. So they decide to go ahead, using FACT or FLOW-MATIC or COMTRAN or COBOL. And the programmers suffer. Those who are of necessity trained in machine, or near-machine, language are agonizingly aware of the sacrifices in program efficiency that are made to achieve a compiler that can be implemented. Those who write in the source language soon become aware of the sacrifices in programming efficiency that are made to achieve a language which 'members of the upper management echelons can read and understand.'

"Do these 'members of the upper management echelons' really gain anything from the use of 'English' source programs? I doubt it very much. The source programs are still written in a degree of detail that should be of no concern to upper management. The essential facts about a system must still be presented to upper management in broad-brush terms having little relationship with the computer English of the source program."

John H. Hughes, *The Trouble with Commercial Compilers.* **Computers and Automation.** July, 1961.

"It is obvious that for any seat reservation system, immediately available high-speed transmission is essential to give maximum control: the same might apply to some form of stock control, and, in very tight time-schedules, to schemes for payroll, but in general one wonders just how many occasions are there, or will there ever be, when it is essential to send data immediately rather than wait for overnight post or transport, quite apart from the question of comparable costs. A great deal is made nowadays of the value of ADP in providing up-to-date records for management. How up-to-date do these have to be? Up-to-the minute, up-to-the day, up-to-every-two days or only up-to-the week? Out-of-date records certainly imply waste of money but how far the other way does this pendulum have to swing? Only management can answer this, and by answers to such questions as these a clear lead could be given to developments in the three associated fields of character recognition, data transmission and document handling."

Daphne P. Kilner, reporting in the June, 1961, **Bulletin of the British Computer Society Ltd.**

(continued from page 46)

a special program which converts data from one form to another, and a magnetic tape sort generator. Three types of routines are supplied: one initiates action to correct read/write errors on magnetic tape; a second provides for memory dump, and the third is a trace routine for debugging.

Peripheral equipment

Input-output devices available are:

B124 Card Reader, two of which may be used — 800/minute or 200/minute models — both serial card readers with photoelectric sensing. Both use immediate access clutch and read either standard punched cards or binary forms. Punched cards can be 51, 60, 66 or 80 columns.

B304 Card Punch has a speed of 300 cards per minute.

B321 Printer is a 120-position wide line drum printer, providing alphanumeric and numeric printing at 650 lines per minute double spaced; over 700 lines a minute single spaced. There are ten characters an inch vertically.

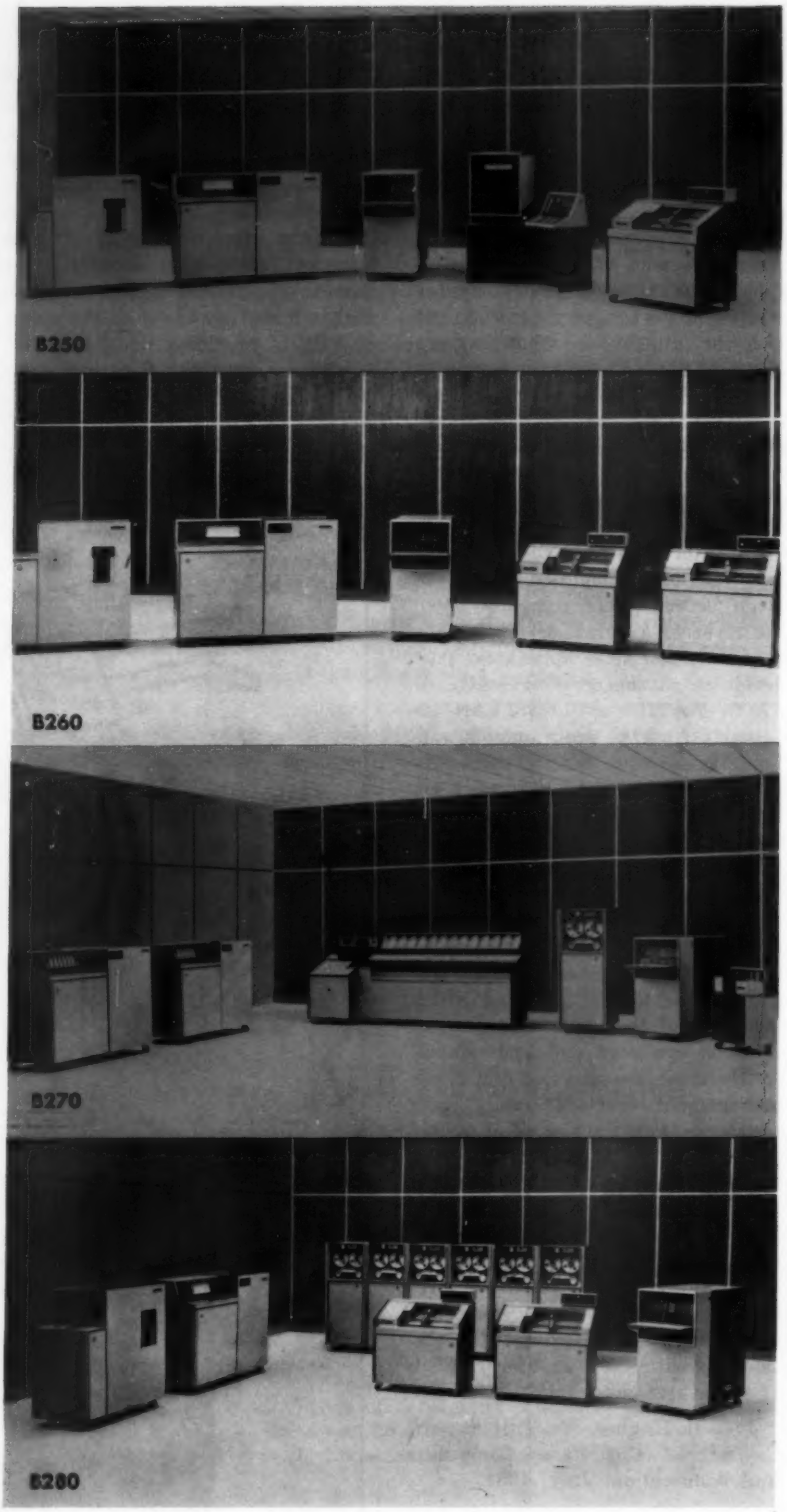
B421 Magnetic Tape Units, up to six of which may be installed, operate at 50,000 or 18,000 characters per second, read forward at 90 inches per second, rewind at 320 inches per second. Packing density is 555.5 or 200 character frames per inch. Dual gap read/write heads allow two-way parity check.

B401 Record Processor is a ledger processing unit which reads from magnetic stripes on back of record document; it automatically feeds, reads, prints, writes on and ejects record document.

B322 Multiple Tape Lister is a drum type printer with self-contained buffer. Each unit has six individually controlled tapes, with 22 printing positions on each tape. Maximum speed is 1,600 lines per minute (35,200 characters).

B100 Sorter-Reader is used for magnetic ink encoded documents.

The basic punched card computer system, the B260, will rent for $3,750 a month; sales price $183,650. The magnetic tape systems will range from $252,180 to $384,780 selling price; monthly lease rates will be $5,235 to $8,435.



The new Burroughs Corporation B200 family of small and medium scale computing systems includes four models: the B250, which uses a record processing unit in addition to punched card handling equipment; the B260 basic punched card system; the B270, especially suited for banking applications; and the B280 magnetic tape system. The B260 system, designed for large volume punched card applications, provides great productivity in the low-priced class.

Circle no. 30 on reader service card.

PRODUCTS SERVICES

ATF OFFSET DUPLICATORS

American Type Founders has set up a Business Equipment Division and is entering the business machines field with two offset duplicators, the ATF Chief 15 and the ATF 1015. The company will also soon market an electronic programming unit which can control the operations of the 15 and similar offset reproduction equipment.

The Chief 15 handles sheet sizes from 3 by 5 inches to 11 by 15 inches, and reproduces in black and white or color. All normal operating adjustments are made without tools. There is a 10 position speed control which covers a range of from 3,400 to 7,200 impressions an hour. The ATF 1015 is a similar but smaller machine, and handles sheet sizes from 3 by 5 inches to 10 by 15 inches.

The transistorized ATF Automated Programming Unit can control the sequence and the number of copies of a reproduction run. ATF also distributes various makes of process cameras, platemakers, paper cutters, and allied equipment and supplies.

Circle no. 40 on reader service card.

UNIVAC PRINTER OPTIONS

Univac has three new options for their line printers. Line printers for the Solid State and File computers, and the Univac Compatible printer, may now print at either six or eight lines per inch. Speeds of the Univac 101 line printer (on-line, off-line, or Compatible) may be increased from 600 to 660 lines per minute for alphanumeric data, or to 800 lpm for pure alphabetic or numeric, with a second option.

The third new option increases the printing speed of the Univac 16 to a maximum of 750 lpm for pure alphabetic or pure numeric, or by about 10 percent for mixed data. All three options are available now and may be installed on site or at the factory.

Circle no. 41 on reader service card.

NEW FRIDEN PRODUCTS

Punched paper tape and edge card duplication and verification are possible using a line of tape comparator equipment and additions to tape regeneration equipment produced by Friden, Inc. Duplication and verification are possible for any 5, 6, 7, or 8-channel code. Eight new systems are possible using combinations of the new equipment.

For data transmission or computer input, a number of short tapes (or edge cards) may be duplicated onto a long composite tape, with automatic verification of the reproduction. Straight verification of two duplicate tapes is done at 1,200 characters per minute.

Circle no. 42 on reader service card.

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SIMULATORS FOR H-800

Programs written for the IBM 650 (card or tape), the Univac I and the Univac II, may be run on a Honeywell 800 using new simulators offered by Minneapolis-Honeywell. Tape programs require conversion to 800 tapes; card programs are run without conversion. The 650 simulators require an 800 with at least 4,096 words of memory; the Univac simulators require 8,192 words or more. The 800 system used to simulate other machines must also have the same number and types of input and output equipment as the computer system for which the original program was written.

Circle no. 43 on reader service card.

DATA TRANSMISSION AT FULL TAPE SPEED

IBM has linked two of its computer centers, one in New York City and the other 68 air miles away in Poughkeepsie, by a data communication system using telephone cable, microwave, and IBM's newly developed 1945 magnetic tape transmission unit. Using 729 tape drives at each location, the system is currently sending data at 15,000 characters per second, in either direction or in both simultaneously. With modification of the communications equipment used in the system, the IBM 1945 can transmit and receive at the maximum rate of 62,500 characters per second. Using the new equipment, two computer installations may be managed as a single facility, regardless of the physical distance between them. The 1945 will rent for approximately $1,000 a month.

Circle no. 44 on reader service card.

ELECTRONIC DATA PROCESSING INSURANCE

As a result of market research following the multi-million dollar Pentagon fire, the St. Paul Insurance Companies are offering an electronic data processing policy which 1) insures electronic data processing equipment, 2) insures the reproduction costs of magnetic tape and expense of assembling information, and 3) covers extra expenses necessary to return to a normal operation after a loss occurs. A computer room fire can not only destroy equipment, but also valuable magnetic tape data, and many firms would have difficulty estimating their risk. The new policy is designed to give protection in such cases.

Circle no. 45 on reader service card.

IBM SELECTRIC TYPEWRITER

There are no type bars or movable carriage in IBM's new Selectric typewriter. Instead, a single sphere-shaped element carries all type faces, moving from left to right across the paper as the typist strikes a conventional keyboard. The element is removable and may be replaced by the typist with an element bearing another type style. The stationary carriage takes up less desk space, and there is no carriage return jolt.

Another interesting feature of IBM's new style typewriter is that in the event the typist strikes two keys almost simultaneously, the machine will print the first character while remembering the second, and then print the second. IBM also has redesigned the ribbon feed feature, using cartridges which may be snapped in or out of the machine without any handling or feeding of the ribbon itself.

The price for an IBM Selectric which takes paper up to 11 inches in width is $395. For a larger model, which can use paper up to 15½ inches wide, the price is $445.

Circle no. 46 on reader service card.

NEW MODEL UNIVAC SOLID STATE

Remington Rand Univac is offering a Univac Solid State II computer with a magnetic core memory unit in addition to the Solid State's magnetic drum. Housed in a separate cabinet, the core unit has an access time of 1.5 microseconds, and a cycle time of 17 microseconds for an 11 digit word. Capacity of the core storage unit is 14,080 digits, bringing the maximum memory capacity of the Solid State II to 110,880 digits if the largest available drum is used. A block transfer instruction may be used to transfer up to 2,200 digits between the two memory units at 1.5 microseconds per digit. The most effective way to use the Solid State II's combination drum/core memory probably is to store instructions on the drum, using minimum latency techniques, and use core storage for data.

Univac has a symbolic assembly system for the Solid State II known as S^4. Programs written for an SSII in S^4 terms may be translated on an SSI. Other new features of the SSII include a capacity of up to 20 magnetic tape units, using two synchronizers, nine index registers, and a new alphanumeric comparing feature. The smallest Solid State II configuration will rent for about $6,500 a month.

Univac has also made some changes in the specifications of the Solid State I computer, of which about 300 are installed. These changes include the availability of a 600 card per minute reader at the same price as the 450 cpm reader; and, for the minimum STEP configuration, the provision of three index registers as a standard feature plus the addition of a 2,000 word band of high speed storage to the drum, at a change in basic rental from $3,500 to $3,650.

Circle no. 47 on reader service card.

SALES RECORDER AND READER

Associated Sales Analysts and the Photologics Company have developed two machines to aid in preparing computer input from sales tickets. A store using the system would have a Photologics Sales Recorder on the premises. Sales tickets bearing printed and punched data are fed into the recorder and photographed. Once recorded, the tickets may be retained at the store. A reel of film from the recorder is sent to the computer installation and placed in the Photologics Reader, which develops the film and transmits the data directly into the computer at a rate equivalent to 18,000 stubs a minute.

Circle no. 48 on reader service card.

GOLD STAR FILES

Wright Line is marketing a line of card handling filing equipment, Gold Star files. Chief feature is in the design of card drawers so they may be used for card handling at the machine.

Circle no. 49 on reader service card.

NEW TYPE ENVELOPE

American Business Systems has a newly designed multiple carbon form set which includes an envelope which can be used for remittances

or other purposes. When included in an invoice set, the first sheet of the form may be used by the customer as a payment envelope. For internal purposes, tapes, cards, and papers relating to a transaction may be inserted into the jacket opening of the form.

Circle no. 50 on reader service card.

RESERVATION SYSTEM

United Air Lines has put into operation the largest integrated commercial electronic data processing system in the world. The system includes three solid state Telefile computers, 827 counter-top sales agent sets, and a 12,000 mile communications complex which requires 150 tons of equipment. Designed by Teleregister Corporation to specifications developed by United and Stanford Research Institute, the system has been named the Instamatic airlines reservation system and will be able to handle 180,000 reservations daily. The cost of the system was 16 million dollars.

Circle no. 51 on reader service card.

NEW ACCESSORY EQUIPMENT

Systems Sales Company has a new High-Style line of computer accessory equipment designed to match the styling of computer units. Included in the line are storage cabinets, inquiry station tables, and keypunch desks.

Circle no. 52 on reader service card.

LGP-30 AS SCORE KEEPER

A Royal Precision LGP-30 was used as score-keeper in the 15th annual Powder Puff Derby — the

(continued on next page)

Central control area of the United Air Lines Instamatic System.

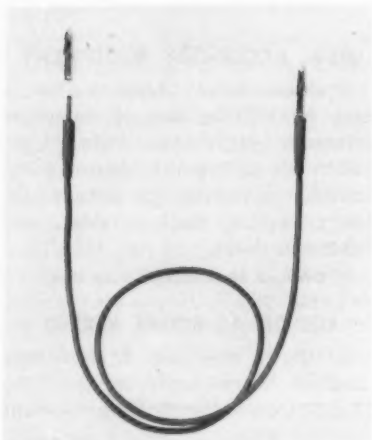
all women transcontinental air race from San Diego to Atlantic City. Since many classes of aircraft were involved, a par was established for each leg of the course for each horsepower rating, and scores were computed by a comparison of this figure with the average ground speed attained. Prizes were awarded in a number of categories, for the entire course, for each leg, and for best performance in each aircraft class. The scoring problem which previously took about 24 hours of work by each of three desk calculator operators, was done with the LGP-30 this year in a few minutes.

Circle no. 53 on reader service card.

NEW TRW COMPUTERS

Thompson Ramo Wooldridge is producing two new computers, the TRW-330, an industrial control computer system, and the ANUYK computer, designed for military uses.

Circle no. 54 on reader service card.



WIRE TIPS FOR CONVERSION

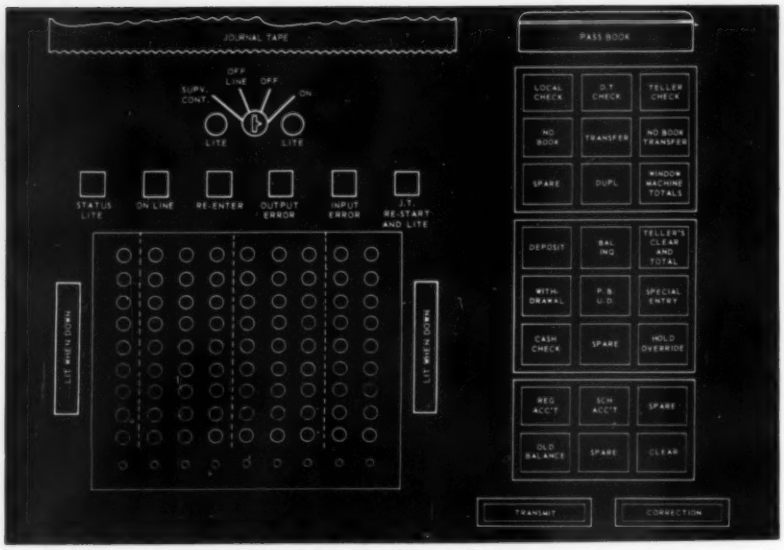
Jack-type control panel wires can be converted into self-contacting wires with Terminal Tips, produced by Clarkson Press. The tips are available in boxes of 500.

Circle no. 55 on reader service card.

BURROUGHS E 103 REDESIGNED

Burroughs has combined its E 103 desk-sized computer with a ten-total typewriter accounting machine. Key feature of the new E 103 is its ability to print alphabetic data on accounting forms. A re-manufactured system sells for $29,000 and rents for $1,200 monthly.

Circle no. 56 on reader service card.



Keyboard layout, Unisaver teller set.

UNISAVER

Univac has a new savings bank teller set designed for use with its 490 computer. The device, called Unisaver, is used for on-line communication to and from the 490 over leased telephone line. Account number, amount, type of transaction, and other data are sent to the computer; the Unisaver produces a journal tape and also prints new balance information in the customer's passbook.

Circle no. 57 on reader service card.

NEW 1401 PROGRAMMING SYSTEM

IBM is now offering a programming system, FARGO, for its card 1401 systems. Using FARGO, instructions are stated in a way similar to descriptions of 407 accounting machine runs. Also, FARGO does not require a separate compiling run on the 1401: programs written in FARGO terms are immediately usable for a production run after conversion and without reloading.

Circle no. 58 on reader service card.

RR-300 TAPE READER

Rheem Manufacturing Company has a new paper tape reader, the RR-300, which reads 5, 7, or 8-channel tape at 300 characters per second. Start time is eight milliseconds; the reader will stop on one character from full speed. The price of the RR-300 is $845 F.O.B. Los Angeles.

Circle no. 59 on reader service card.

BEEKLEY PRODUCTS

Beekley Corporation has several products designed for use in data processing systems. The company produces a line of needle-sort, marginally-punched card systems, including both the cards and equipment for notching them. Another product is complex manifold sets of up to 22 parts. A third is a simple manual information retrieval system called Insight, in which data are represented by holes punched in a grid on a characteristics card.

Circle no. 60 on reader service card.

■ ■ ■

AUTHORS

(continued from page 4)

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GIBBS MYERS *(Coding Business Data)*, manager of systems & procedures, Kearfott Division, General Precision, Inc., received his A.B., and M.A. from the University of Maryland, and a Ph.D. from Yale University. His previous work included: tabulation review supervisor, Department of Agriculture; tabulating supervisor and administrative assistant, Census Bureau; assistant archivist for the National Archives; industrial engineer, Brewster Aeronautical Corporation; manager of general services and director of methods and procedures, Federal Division, ITT.

Dr. Myers is an instructor in accounting systems at Rutgers School of Business Administration, and has organized and taught several systems courses for their extension division. He is a frequent lecturer and has authored many systems articles which have appeared in a number of publications. Founder and past president of the Northern New Jersey Chapter of the Systems and Procedures Association, he has also served as director, secretary, and chairman of the national group.

Dr. Myers was named "Systems Man of the Year" by the International Systems and Procedures Association in 1960.■

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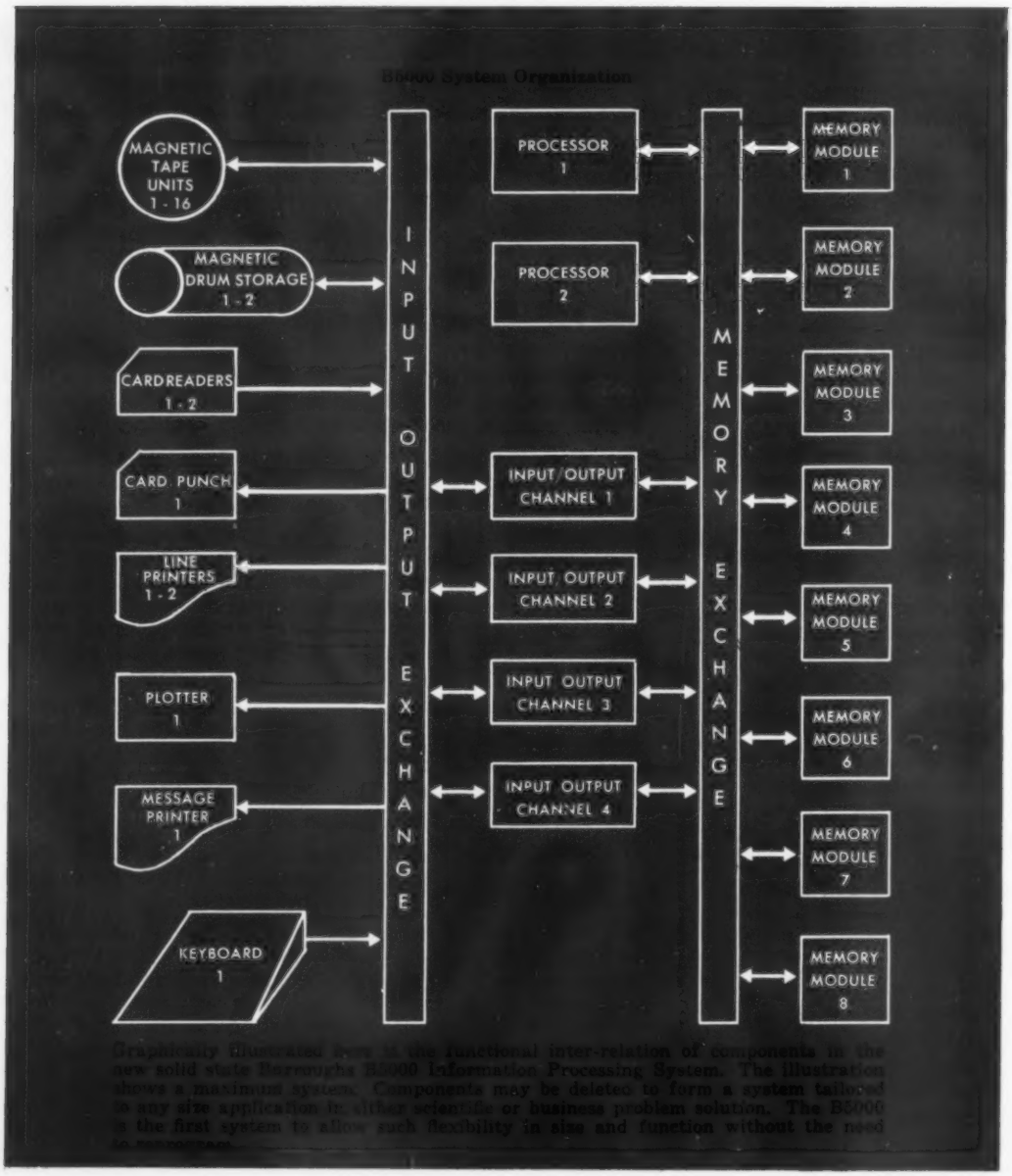
curves or graphs on continuous forms at rates up to 20 points per second.

The Burroughs B5000 is the first really new computing system to enter the field in many years. It is the first to be planned, designed and delivered as a total "hardware-software" system. Dramatic benefits from this approach will accrue to its users. Technical people will be able to spend more of their time thinking about and working on the actual problems they are trying to solve rather than worrying about the housekeeping type of programming problems.

Management will regain some of the control it lost over its procedures when it committed itself to a large data processing system. Special jobs and reports can be produced in a few days rather than waiting for months while programs are written and debugged. Procedures can be changed when conditions require rather than when available programmer manpower and computer time permit. Management will have less concern about outgrowing its system since additional components, even a second processor, can be added to a B5000 system. In effect, the productivity of the system can be doubled. Furthermore, this system growth can be accommodated without the necessity of reprogramming.

FIGURE 1.



DATA . . . yours for the asking

THE COLITHO DIVISION of Columbia Ribbon & Carbon Manufacturing Co. announces a new catalog, listing its offset duplicating plates and supplies, which covers lines fitting any duplicator, small press, high speed data processing equipment, and other electronic and mechanical imaging machines.

Circle no. 70 on reader service card.

GENERAL KINETICS Inc. offers a brochure, *Magnetic Tape Preventive Maintenance*, about its CT-2 Kinesonic Tape Cleaner. This cleaner is designed to eliminate computer down time resulting from dirt, loose oxide, and other contaminations on tape; to increase cleanliness and decrease wear on magnetic recording heads and extend tape life.

Circle no. 71 on reader service card.

HONEYWELL's Data Processing Division has a new brochure, *For Better Business Control*, which outlines the applications and specifications of the medium-scale Honeywell 400. It describes the many applications which the 400 can handle to streamline control of business record keeping and cut the costs of handling paperwork. Listed also are the programming aids and specifications of the system's components.

Circle no. 72 on reader service card.

"LET'S PUNCH A COUPLA BUTTONS AND RUN LIKE HELL, HUH?

LITTON INDUSTRIES' Westrex Recording Equipment division's new bulletin describes a remotely actuated display unit for communications command centers.

Circle no. 73 on reader service card.

LITTON's U. S. Engineering Co. has available a new technical bulletin, *Depth in Circuitry*. It includes complete specifications for all types of printed circuits with descriptions of flexible, flush, and multi-layer circuits, and the "Carte Blanche" series of standardized plated circuit cards. Design and production capabilities are also described.

Circle no. 74 on reader service card.

PHILCO CORPORATION offers a brochure describing in detail the features of the Philco 2400 computer system.

Circle no. 75 on reader service card.

PHILCO 2000 Linear Programming System is the title of a four page color folder which features the LP-2000 system, citing specific aplications of companies which have used linear programming.

Circle no. 76 on reader service card.

STONE LABORATORIES, INC., manufacturer of TELLERTRON information retrieval systems, has published *Phase One: A Real-Time Updating and Transaction Processing System*. This outlines the design approach of a typical system: configuration, operation, optional features, and advantages of the system to banks.

Circle no. 77 on reader service card

TAB PRODUCTS CO. offers a new brochure detailing 12 ways to cut filing costs through the Spacefinder Filing System.

Circle no. 78 on reader service card.

WRIGHT LINE specifies, in three brochures, their new Docu-Tray Check Handling Equipment which will reduce the handling time required to process MICR documents. There are three different types of

(continued on next page)

trays, made for the three major types of MICR sorters:

Docu-Tray for use with IBM sorters.

Circle no. 79 on reader service card.

Docu-Tray for use with Burroughs equipment.

Circle no 80 on reader service card.

Docu-Tray for use with Pitney-Bowes National sorters.

Circle no 81 on reader service card.

THE GEVAERT COMPANY OF AMERICA, INC.'s 29 page illustrated booklet on photomicrography contains technical information about the camera, illumination of specimens, resolving power and light sources of the photographic enlargement.

Circle no. 82 on reader service card.

McDONNELL AUTOMATION CENTER of St. Louis has a brochure explaining its services, which include consulting, systems design, programming, and data processing.

Circle no. 83 on reader service card.

PHILCO is offering a new brochure on COBOL, Common Business Oriented Language; the booklet describes COBOL in relation to the Philco 2000 system.

Circle no. 84 on reader service card.

PLANNING RESEARCH CORPORATION's new pamphlet, *Breakthrough*, outlines policies and inventory rules designed to minimize the sum of inventory costs for the scientific management of inventory for business.

Circle no. 85 on reader service card. ■

BOOK SHELF

ELECTRONIC DATA PROCESSING — AN INTRODUCTION by E. Wainright Martin, Jr. Richard D. Irwin, Inc., Homewood, Ill. 1961. 423 pages. $10.60.

Despite some similarities between this and other introductory texts in electronic data processing, this book represents an important contribution to the data processing field. There are a number of books which use the IBM 650 for instruction in computer programming, as does this one, and the use of payroll as one of the major application descriptions is also common enough. What is relatively uncommon is the balance which Dr. Martin (a mathematician) has struck between technical and scientific considerations on the one hand, and the hard and practical considerations of using a computer in a business setting on the other. The result is a concise treatment of electronic data processing, not presented at the high school or college freshman level, but intended primarily for the graduate student and others of comparable ability.

In addition to a well-written section explaining how to program the 650, the book contains an excellent 50-page summary of the punched card method, and chapters dealing with large-scale computers, random access files, systems analysis and design, computer installation activities and problems, considerations in the organization of a data processing activity, and a most interesting concluding chapter which Dr. Martin titles "Management Responsibility Toward Information Technology." There are four appendices and an index, and each chapter is followed by a summary, a thoughtful set of exercises, and a subject bibliography. In addition, the book is liberally footnoted with specific references.

Obviously very well grounded in his subject, the author emphasizes the value of block diagrams and flow charts in the design and use of data processing systems; shows clearly how to tie a coded computer program back to its block diagram; and follows his own advice by making full use of both flow charts and block diagrams throughout the text. On the subject of diagrams, those familiar with the widely circulated general block diagram of "How to get to work in the morning" will be interested in a new switch incorporated into Dr. Martin's version. For clarity, organization, and substance, this new book will be hard to surpass.

LABOR ARBITRATION by Maurice S. Trotta. Simmons-Boardman Publishing Company, 30 Church St., New York 7, N. Y. 1961. 438 pages. $10.00.

With the growing concern over office unionization and the effects of electronic data processing on office workers, this new text should be good background reading for management personnel who have a responsibility in their company's data processing program. Part one of the book develops basic principles and procedures of labor arbitration. In part two, the case study method is used to examine major issues which have resulted in arbitration. This book is a definitive text on its subject.

COMPUTERS AND HOW THEY WORK by James D. Fahnestock. Ziff-Davis Publishing Company, 1 Park Ave., New York 16, N. Y. 1959. 228 pages. $4.95.

Written in the popular vein at about the high school sophomore level, this book attempts to explain virtually the whole gamut of computer technology in simple terms. The book should be useful to any person who has no mathematical background but has a need to know about computer circuitry. Both digital and analog computers are considered. The book has an index.

ELECTRONIC COMPUTERS AND THEIR BUSINESS APPLICATIONS by A. J. Burton and R. G. Mills. Ernest Benn, Ltd., Bouverie House, Fleet St., London, E. C. 4, England. 1960. 325 pages. 45 shillings.

As A. J. Barnard put it in the preface, this book would have saved many a trying time, had it been written six years ago. Organized in three sections — equipment, techniques, and applications — the book illuminates the thorniest of the problems of using computers for business purposes. It is written for the serious reader, and will require concentration and thought. The results of a careful reading, however, will be rewarding: the general reader will gain a good appreciation of why it takes so long to place an application on a computer; the programmer will find a fresh and stimulating discussion of his work; and both will perhaps see interesting possibilities in the latter part of the book, where basic business applications are analyzed in terms of the authors' imaginary computer, CASSEAC.

The American reader in particular should find some food for thought in the English approaches described for payroll, sales accounting and stock control, government applications, insurance, stock exchange, banking, and share registration, to each of which is devoted a chapter reviewing the basic data processing functions involved and suggesting one or more ways of handling the task on an electronic computer. In three chapters about programming, some fairly common misconceptions of what constitutes a good program are neatly exploded, to be replaced with more prosaic ideas which can only be the result of practical programming experience. A short chapter on staffing the installation is also worthwhile. It is significant, too, that the authors leave their fancies behind and do not indulge in speculation about the future role of the computer except in a seven-page final chapter. The book has five appendices and a thorough index. ■

INDEX TO ADVERTISERS

editorial

ROUNDTABLE

Effects of Electronic Data Processing on Office Personnel

ON SEPTEMBER 19, 1961, **Data Processing** magazine sponsored a discussion of displacement and other effects on office personnel resulting from the installation of electronic data processing. Meeting in a roundtable conference in Detroit were nine men who represented users, government, labor, education, consulting services, and associations.

This diversified group, who at first glance might seem to have little in common except a studied interest in the subject, proved to have many similar viewpoints, and of course, some areas of disagreement.

Participants included: Professors Albert Blum and Einar Hardin, Michigan State University; John Diebold, John Diebold & Associates, management consultants; H. B. Douglas, Office Employees International Union; Adrian A. Flakoll, special assistant to the Deputy Secretary of Labor, Washington; Dr. Arvid W. Jacobson, ACM's chairman, Committee of Responsibility of Computer Users; Paul M. Pair, NOMA; Everett E. Roll, Detroit Edison; John C. Thomson, Hardware Mutuals-Sentry Life Insurance Company, Wisconsin.

The following few provocative quotes from the discussion will be further expanded in later issues:

"Manufacturers of data processing equipment have a responsibility to let the customer know the problems—social and psychological—in addition to just the technological. This is not to tell the customer whether he is or is not to keep people, but to prepare him for the problems."

"Our studies show that variable factors influencing attitude toward change are the social, educational, and economic level of the employee, with those on high level amenable to change and those on lower levels more opposed. Supervisors are more ready to change than are those in non-supervisory capacity."

"Displacement is not a synonym for unemployment, it is a move to another type job or location. It may be more serious as a social and psychological problem than actual unemployment."

"The dull monotonous job has been improved for some, deteriorated for others. In computer areas the work is more interesting, other departments which lost work to the computer felt their work was more boring."

"It is very important, therefore, that employees (both in government and industry) be kept fully informed about management's plans during the entire conversion process—this procedure will save many later problems."

With the November issue of **Data Processing** we will begin detailed reports on this most stimulating and enlightening discussion. ■

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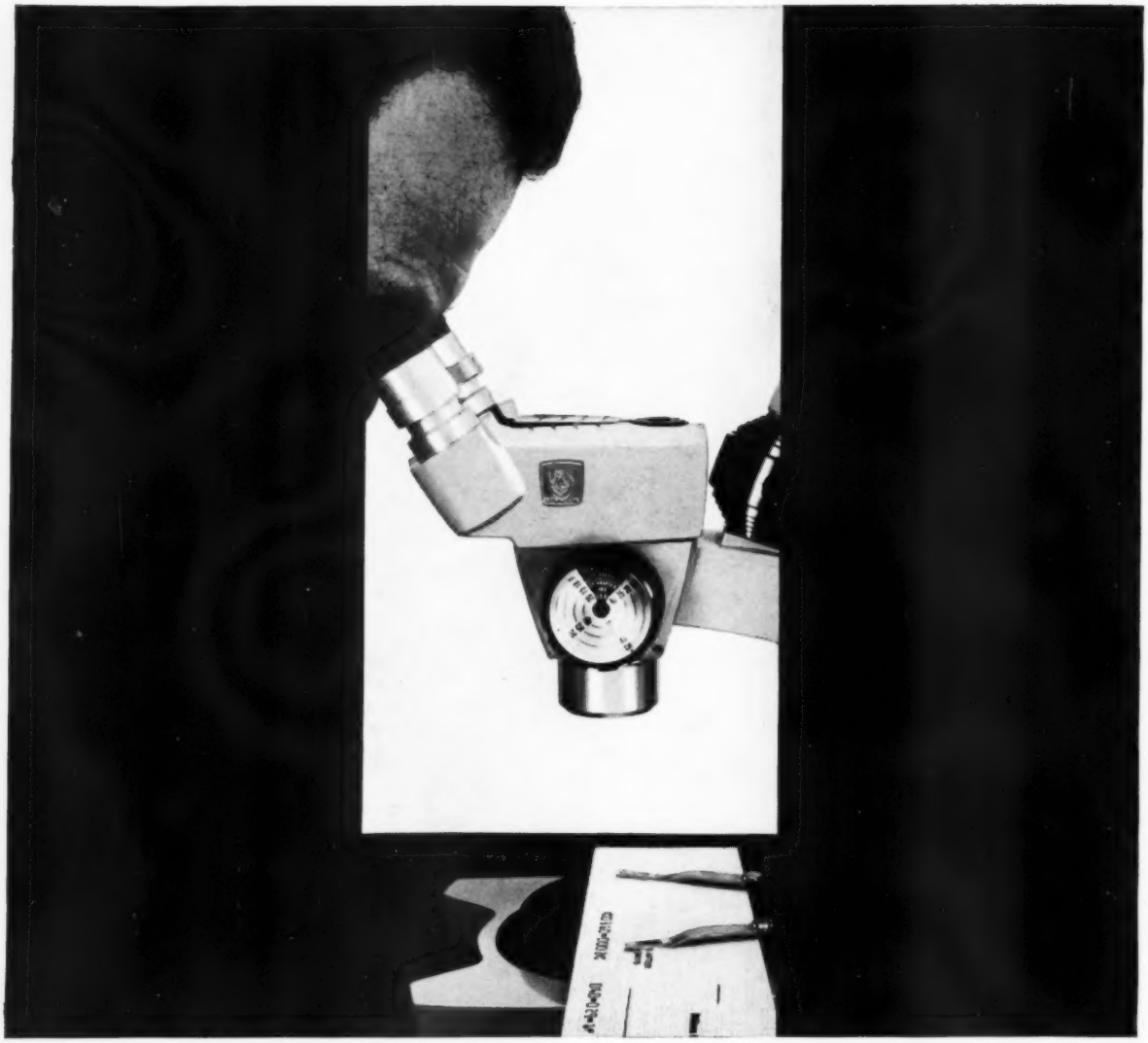

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